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Methods of Machine Tool Design

Usual Machine Design Methods Do Not Always Apply in Designing Machine Tools—Definition, Classification and Requirements of a Machine Tool

By A. L. DeLEEUW

THERE are many books in existence dealing with the design of machinery in general. As a rule such books treat mostly, if not exclusively, of the design of machine elements, such as bearings, shafts, keys and clutches, connecting rods and valves, or gears and cams and pulleys. Others again deal with the complete design of certain classes of machinery, such as generators, or steam engines, or turbines, or hydraulic machinery.

Having thoroughly absorbed the substance of one of this latter class of books the reader would be able to design some such machine himself and, though that machine might not be the best ever designed, yet it would contain all that is necessary to give it a certain amount of success. There are also books which deal exclusively with the design of machine tools, but they differ from the second class which was mentioned above in so far that the student, after thoroughly absorbing the contents of such a work would yet not be able himself to design a machine tool.

BOOKS TELLING in detail how to design engines, generators, hydraulic machinery, etc., are ready to the hand of the designer. When he tackles a machine tool, however, there is nothing of the sort available and the problem is a much more difficult one, besides.

Each design has its own peculiar difficulties and in addition the difficulties inherent in its type, whether it be a standard or single-purpose machine.

Nevertheless, it is quite possible to employ systematic methods in tackling each individual case. The development of such methods by one of our best machine tool engineers is the purpose of this and succeeding articles.

In the following pages an attempt will be made to describe the processes through which the designer should go when designing a machine tool. It will be taken for granted that he has the necessary knowledge of the design of machine elements or, at least, that he knows how and where to get it.

It might appear that the rules which hold good for the design of any other kind of machine should also be applicable to machine tool design; but as a matter of fact there is a great difference in the processes involved when designing a steam engine or generator or boiler, and those used when designing a machine tool. One of the main reasons is that there are no well-established data from which to start.

Designing a steam engine we start with the amount of power to be developed and we know which well-known elements we should use to obtain the desired result. We have a general picture of the machine we are going to develop and we know the order in which the details must be taken up. All the problems which come up in the design of a steam engine have been studied separately and the results have been placed on record. To design a steam engine of given horsepower our first question is: What is the pressure of the steam? We then decide what cut-off we shall use and from this we determine the mean effective pressure. We select the length of stroke and we will be guided by considerations which the problem has brought before us. Having mean effective pressure and length of stroke, we can at once determine the diameter of the cylinder. We can now check up diameter and length of stroke in relation to each other and, if necessary, modify our first choice. Knowing the cut-off at which we wish to operate, we can lay out the valve motion. In this manner the various elements of the steam engine are brought together and put into concrete form step by step. The same general method holds good for many other classes of machinery, but not for machine tools. As was said before, there are no well established data available.

Besides, there are other reasons. A number of elements which do not enter into the design of most classes of machinery are of great importance in the design of a machine tool, and even such elements as are common to the machine tool and other classes of machines are of different relative importance in machine tool design. To illustrate this latter statement: One of the great elements in the design of a steam engine—economy of power—is a minor consideration in the design of machine tools. We are perfectly willing to spend a few extra horsepower if, on the other hand, we can obtain economy of production—a factor which does not exist in the steam engine. Such elements as handiness, accessibility, freedom from vibration, provision for taking up wear, etc., are of the greatest importance in machine tool design, though of secondary importance only in the design of most other classes of machines.

Not only do we lack fundamental data, but our requirements are never definitely stated. In designing

a steam engine we know exactly what strains the various parts of the engine must resist and we can build accordingly. The strains in the engine never exceed a well-known maximum and depend entirely on horsepower and speed. In a machine tool the strains to which the machine is subjected depend, it is true, on the nature of the material to be cut and on the size of cut, but they depend also on a number of other things such as the shape of the tool and the degree of sharpness to which it is ground. A machine tool may from day to day or, for that matter, from hour to hour, take entirely different cuts with entirely different tools and in entirely different materials. There is no positive limit as to the amount of power which must be transmitted by the mechanism of the machine. If the machine is designed for a 6-in. belt and the user finds that he does not have enough power to take the cut he wants to take, he tightens the belt; or, if he has a motor drive, he substitutes a larger motor. Neither the designer nor the builder is consulted in this matter. After the machine tool leaves the hands of the manufacturer it gets into the hands of somebody who is concerned with one consideration only, and that is how to get the greatest amount of production out of that machine. The user of a steam engine would not dare to double its speed, for the flywheel might burst; the user of a boiler does not dare to increase the steam pressure, for the boiler might blow up; the user of a dynamo or motor does not dare to increase the wattage, for the insulation would burn out; but the user of a machine tool is not limited in any sense and may keep on imposing heavier and heavier duty on the machine until it breaks down, and then he blames either the manufacturer or the designer or both.

As a result of this lack of definite information and definite aim, machine tool design has depended almost exclusively on slow evolution. It has been almost entirely in the hands of men who were familiar more with the art of running the machine than with the art of originating it. During a period of many years a certain amount of knowledge has been accumulated and has been transmitted more or less by word of mouth from one generation to another. Most designers when dealing with the design of machine tools have a fairly clear idea as to the requirements of the machine they are to design, but it is doubtful if many have considered the order of importance of these requirements.

Classification of Machine Tools

Machine tools might be divided into two classes, special machines and commercial machines. Though there is little difference in mechanical requirements of these two classes there is a great difference in the relative importance of these requirements. For example, the chief requirement of any special machine is that it shall do properly the work it is intended to do. Though this also is one of the main requirements of a commercial machine, it is not the chief one. The chief requirement of a commercial machine is that it shall be marketable at a profit and as, of course, it cannot be marketable unless it fulfills its duty, it must also be suitable to the purpose for which it is built. As a result, it is not so essential that one should carefully consider the cost of manufacture of every detail of a special machine. On the other hand, as a special machine is made for one purpose only, and as that purpose is definitely known, it *is* of the greatest importance that it shall be as economical—that is, as productive—in its operation as it is possible to make it. Though this same thing is desirable, again, for a commercial machine, it is absolutely impossible to make it the main feature for all the kinds of work that might be done on it. It stands to reason that a 36-in. lathe can never be so productive for the turning of a ½-in. shaft as a 10-in. lathe can be; nor can the 10-in. lathe ever be so productive for a 7-in. shaft as the 36-in. lathe can be.

There is a class of commercial machine tools which is built for one purpose only—the single purpose machines. We might, therefore, divide machine tools as follows:

1—Special machines; 2—Commercial machines:

2a—Single purpose machines; 2b—General utility machines.

The class 2a does not offer as many difficulties to the designer as 2b, but he has still to reckon with the requirements of economy of manufacture, which is one of great importance in all commercial machines.

Requirements of Machine Tools

The chief requirements of any machine tool whether special or commercial, are the following:

(1) It must function properly.
(2) It must have the necessary strength.
(3) It must have the necessary rigidity.
(4) It must have the necessary power for the cuts intended.
(5) It must have the necessary feeds and speeds for the range of work and cutting speeds which might be handled on a machine of this type.
(6) Parts must be so proportioned as to hold wear down to a minimum.
(7) Provision must be made for the taking-up of wear which may affect the accuracy of the product.
(8) All take-ups, adjustments and parts liable to breakage must be easily accessible.
(9) The machine must be so constructed as to allow of ready repair. In other words, it must be easily assembled and disassembled.
(10) Parts should be so designed as to allow of economical manufacture.
(11) The machine must be easy to operate.
(12) The machine should have a pleasing appearance.
(13) It should be possible to handle and ship the machine by proper means without danger of breakage or distortion.

Many other minor requirements might be mentioned, but the requirements given above will give sufficient material for the following articles, and will bring up naturally those requirements not mentioned here.

As to the order of their importance, there might be some discussion in regard to some of them, but this much is sure: that number one will have to stay in its place, as meeting all the other requirements is of no benefit unless the first requirement is met—that is, unless the machine functions properly.

For the purpose of the subsequent discussions we will give the following definition of a machine tool:

A Machine Tool is a Metal Working Machine for the Removal of Material from a Piece of Work and Containing Means for Holding, Guiding and Controlling the Work, or Tool, or Both.

A machine tool is therefore an organization composed of a number of elements which in themselves may be organizations, and of which each element has to be capable of performing a certain function. There must be a mechanism, there must be means for holding the work, means for holding the tool, means for guiding either or both, and means for controlling the various movements and conditions. It may be that the same parts are used for more than one function; in fact, this is almost always so. But for the purpose of design we should keep the functions apart. The table of a milling machine guides the work and it also has means for holding it—the T slots. Similarly, the carriage and slides of a lathe or saddles of a planer are the elements for guiding and holding the tool. However, for the purpose of design we consider *one function* at a time.

Designing a Machine

When starting the design of a machine we have nothing before us but a drawing board and some instruments, or perhaps a sketch pad and a pencil. Of course there are cases when a manufacturer takes an existing machine and modifies it and calls the result a new design; and so it is, as far as the trade is concerned. But to the designer it is merely an alteration; or, in other words, the problem of designing a part of a machine. We are concerned here with designing "from the ground up."

To try to build up from this zero condition to the complete machine is very much like trying to build up a pyramid standing on its apex. We should start in with the finished machine, and we should imagine that this machine has been completely designed and will do the work for which it is intended. We then analyze this imaginary machine and find what main units are required to build it.

We should follow very much the same method as we employ when looking up railroad connections if we wish to be at a given place and at a definite time. The man in Philadelphia who has to meet an appointment in Milwaukee at a given day and hour does not start looking up the various trains he can take out of Philadelphia. Rather he looks up the various trains which would bring him in Milwaukee at the proper hour, and he finds that in order to meet his demands he must take a train from Chicago at a certain time. Then he works back, finding a train which will bring him to Chicago at such a time as will enable him to make connections for Milwaukee. There may be various combinations which will fill his requirements. He compares these combinations and selects the simplest, or quickest, or cheapest, or the one with the most agreeable scenery, or possibly the one which gives the best sleeping- and dining-car service—all according to what he wishes to accomplish on his trip. After he has determined in a general way which road he will take, he goes into details.

Analogies are never quite correct and this is a case in point. When we look up railroad trains we merely make a selection of existing conditions; but when we design an entirely new machine we have, as a rule, no existing functional units to choose from. On the other hand, this is not necessary for our first plans. We simply take for granted that in some way we will provide the functional units on which we have based our general plan.

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Romances of Metal Working—The Story of Hal of the Wind

By H. H. Manchester

Hal of the Wind, as the legend ran, was a smith and armorer of Perth, Scotland, about 1400 A. D. in the reign of Robert III of Scotland.

On the morning of St. Valentine's day, he was kissed in his sleep by the beautiful Catherine Glover, who thus chose him to be her valentine for the ensuing year. Not long after this, however, Prince James placed Louise, the French glee maiden in his charge, which caused an

HAL OF THE WIND AT WORK

estrangement between him and Catherine, and greatly increased the chances of Eachin, a young chieftain of the clan Quhele.

In the meantime, Hal, who was also known as Henry Smith from his occupation, and Henry Gow from his personal characteristics, was busily making armor for the courtiers and the clansmen. In fact, it was said that no smith in Scotland could duplicate a piece of Italian armor but him.

The feud between the clan Quhele and the clan Chattan finally became so bitter that the king authorized a tournament to the death on the plain at North Inch, near Perth, between the two clans. When the clans assembled, it was discovered that one of the representatives of the clan Chattan was not present, and although Henry Smith was a member of neither clan, he offered to fight in place of the missing warrior.

In the fight which followed, Hal of the Wind did prodigies of strength and valor, while the armor which he himself wrought stood up against every assault. The outcome of the fight was that the clan Quhele was practically wiped out by the death of some thirty of its strongest men, while Eachin alone escaped to either exile or suicide.

Smith was offered a knighthood but refused. Soon afterward he married Catherine, and many families are proud to trace their ancestry to him, while his story is enlarged upon in Walter Scott's "Fair Maid of Perth." The prevalence of the modern name Smith is good proof of the number and importance of the Smiths in Mediaeval times. As run the old verses:

"From whence came Smith,
Albe he knight or squire,
But from the smith
That forgeth at the fire?"

The Assembling of Bevel Gears

Adjustment of Pinion and Adjustment of Gear Produce Different Results—Gears Should Be Cut with Allowance for Backlash—Bottoming of Teeth

BY CHARLES H. LOGUE

THE present object is to furnish simple comprehensive instructions for the proper assembly of bevel drive gears for automobiles. A special endeavor has been made to avoid technicalities and to present the entire matter as simply as possible.

It is impossible to assemble a pair of spur gears incorrectly providing the shafts are parallel, but unfortunately this is not the case as regards bevel gears. With spur gears it is simply a matter of securing the engagement of cylindrical pitch surfaces, which automatically adjust themselves to any position in which the gears are placed. So long as spur gears may be freely operated their action will be correct, providing, of course, that they are correctly cut.

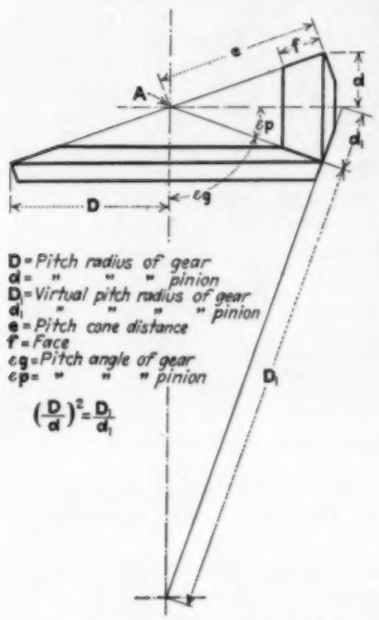


FIG. 1. PITCH SURFACES OF BEVEL GEARS

In bevel gears the pitch surfaces are conical and it is necessary that the apex of each cone coincide with the intersection of the gear and pinion axis. (See point *A*, Fig. 1.) Adjusting facilities are simply for the purpose of securing this intersection, the correction of which is evidenced by the bearing on the length and profile of the teeth, as will be explained. Gears do not require adjustment to compensate for wear, so a correct position once attained should never be altered.

It is apparent that the pitch of a bevel gear varies throughout the entire length of the face; we have, say—four pitch at the large end and five pitch at the small end of the tooth. Quiet, efficient operation requires, first of all, the engagement of equal pitches. Flush engagement at the large ends of the tooth does not necessarily mean the engagement of equal pitches on account of variations in machining of the gear blanks and to varying amounts of distortions in hardening; engagements at small ends are still less dependable on account of variation in length of face. An approximation of the correct position, so far as the relation of ends of teeth are concerned, may be found by rolling the pinion in the gear by hand.

The only real determination of this requisite engagement is by means of the tooth bearing, which may be seen by painting the teeth with a mixture of red lead and oil and running the gears under load. This bearing will occur across certain prescribed portions of the teeth of both gear and pinion and when found as described is positive evidence of proper tooth engagement. For instance, in case the bearing falls too low on the profile of the *gear* teeth it is evident that the pitch of the gear, as engaged, is less than the pitch of the pinion, therefore, the pinion is too far in towards the gear. Should the bearing on the gear teeth run high, the pinion is too far out, away from the gear. A movement of the gear toward or away from the pinion has the opposite effect, but to a decidedly less extent. By referring to Figs. 2 and 3 the relative change in pitch engagement will be apparent. Moving the pinion changes the backlash and consequent bearing along the teeth but slowly as compared to a gear movement, as will be apparent from a study of Fig. 3 so that for all practical purposes we may say that *the position of the gear controls the bearing along the length of the teeth and that the pinion position controls the bearing on the profile or height of the teeth.* Of course, in case the pinion is moved any great distance the bearing along the teeth will also change and must be corrected by re-adjusting the gear. Also any decided change in length of bearing necessitates a new pinion position. The pinion for a ratio of 5 to 1 for instance, may be moved five times as far as the gear for a given change in backlash and the gear moved five times as far as the pinion to bring about a corresponding change in profile bearing.

Equal pitches are engaged when the bearing on the profile of *pinion teeth* extends across its entire working

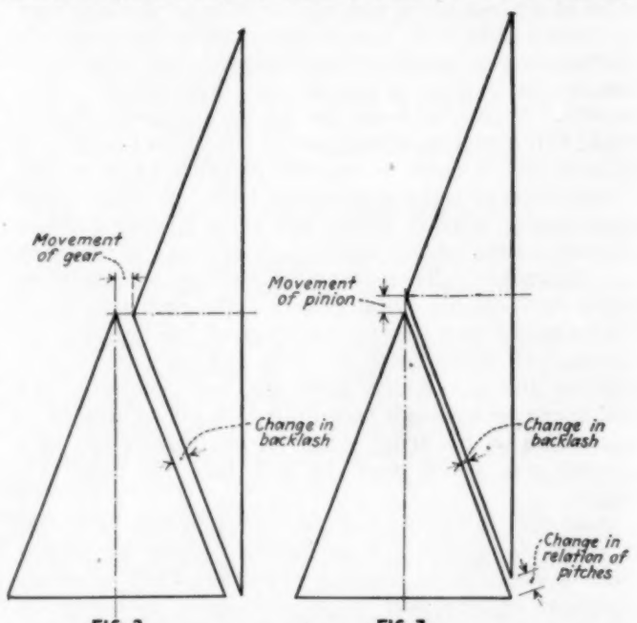


FIG. 2. FIG. 3.
FIG. 2. EFFECT OF GEAR ADJUSTMENT. FIG. 3. EFFECT OF PINION ADJUSTMENT

height from the base line, where the involute curve stops, to the top of the tooth as illustrated by Fig. 4. A bearing heavy on the top (Fig. 5) means that the

pinion is too far forward, toward the gear. A bearing, heavy in flank (Fig. 6) means that the pinion is too far out, away from the gear. Do not attempt to correct bearing along the *length* of tooth by moving the pinion, although in case the bearing is low as shown (Fig. 6) at the same time slightly heavy at the large end of tooth, as in Fig. 7, a forward movement of the pinion might correct both conditions.

Unfortunately, however, it is usually difficult to see the pinion bearing owing to axle construction, so our main dependence must be placed on the bearing which appears on the teeth of the gear. The position of the bearing on the profile of the gear tooth does not extend its full depth and in many cases does not reach the tops

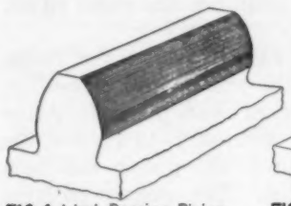


FIG. 4 Ideal Bearing Pinion

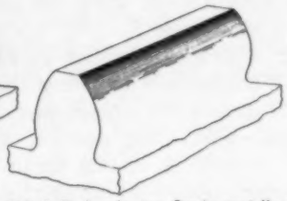


FIG. 5 Pinion in too far, toward the Gear

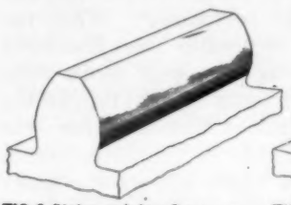


FIG. 6 Pinion out too far, away from Gear

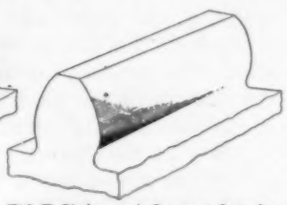


FIG. 7 Pinion out far and Gear too far away from Pinion. Might be corrected by a forward movement of Pinion only

FIGS. 4 TO 7. BEARING ON PINION TEETH

of the teeth so that its proper position is more difficult to explain than that for the pinion.

The introduction states that technicalities are avoided, but in order to offer a satisfactory explanation of general statements as to gear tooth contact as will be outlined, it is necessary to enter a little into the theory of tooth action for the benefit of those interested. Others may skip this portion and take statements made for granted. Fig. 8 illustrates the engagement of bevel gear and pinion, as developed upon their virtual pitch radii. This engagement is shown at three periods—that is, *e* at the point where gear tooth first engages that of the pinion, *g* at the pitch point and *n* as the gear tooth is about to leave pinion tooth at the end of the arc of contact.

Contact cannot occur on the profile of the gear tooth beyond the intersection of the pinion base circle and the line of action, or point *e*. Any portion of the gear tooth extending beyond this point will not show contact, as is in this case evidenced by the distance *f*. That is, the contact on profile will fall this distance below the tops of the gear teeth.

The theoretical height of bearing, above the pitch line, is equal to the pitch radius times $\sec^2$ of the pitch angle times $\sin^2$ of the angle of virtual obliquity. The difference between the addendum, as employed, and the bearing height found as above, represents the distance which bearings will fall below the tops of the teeth. In case the addendum is equal or is less than this amount the bearings should extend clear to the tops of the gear teeth. Contact at *g* being reached the path of the contact on the gear tooth now extends from the point *e* to the pitch line, or the distance *h*. At the end of the engagement the pinion tooth breaks contact with the gear tooth at *n* and the entire path of this contact will be found in the distance *k*. This path of contact should show on the painted surface of the gear tooth.

It is necessary to explain, in this connection, that the contact between gear and pinion tooth is constantly along the line of action. The angle of approach cannot be greater than the angle of virtual obliquity as shown in Fig. 8, so that the bearing above the pitch line of the gear can not extend beyond the point *e* as stated. The angle of recess and consequent depth of gear tooth engagement, below pitch line, is dependent upon pinion addendum. The pinion diameter and obliquity of action affect both of these dimensions.

The point to be derived from this explanation is that the position of bearing is dependable measurement of the accuracy of tooth action—therefore, a proper guide for gear and pinion location. When the bearing is correct the gears are at their best, it is only necessary to know where the bearing should come.

Usual Position of Bearing on Gear Tooth

According to ordinary practice in all straight tooth bevel gears the bearing will fall about $\frac{1}{32}$ in. below tops of the gear teeth. In spiral bevels the bearings will usually extend clear to the tops of the teeth. This is on account of the proportionate gear addendum usually employed for these types. The depth of bearing below pitch line may be readily determined by moving the pinion a little forward, toward the gear, and noting its position. This bearing never goes the full working depth. A study of Fig. 8 will explain this.

A bearing extending from the lowest point (as may be found by moving the pinion slightly forward) to the tops of the gear teeth means a perfect form in both gear and pinion. It is only reasonable to assume therefore that the bearing will often come narrower on some gears than on others as perfection in tooth form is not to be expected. In cases where it is impossible to show

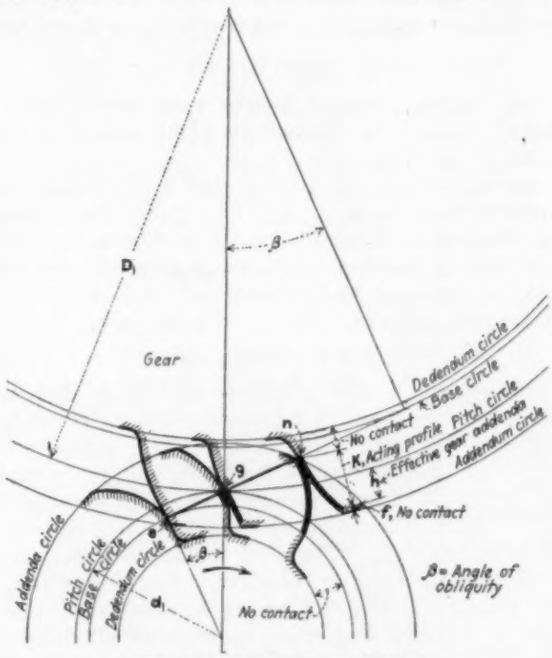


FIG. 8. PATH OF CONTACT

a bearing from the low point (found by a forward pinion movement) to the tops of the teeth, the best plan is to place this bearing in spiral gears so that it will

extend from the tops of the gears to the lowest possible point, that is—let the bearing tend to run high rather than low.

In straight tooth gears let the bearing begin about $\frac{1}{32}$ in. from the tops of the teeth and extend down the tooth as far from this as is possible. In other words for both spiral and straight tooth gears, be sure that the main section of bearing falls across the pitch line.

Bevel gears are properly generated upon the principle that whatever backlash is to be allowed in their operation must be provided for in cutting the teeth and that this backlash cannot be altered unless a change

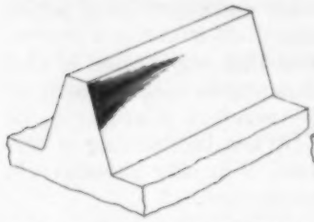


FIG. 9 Move Gear toward Pinion

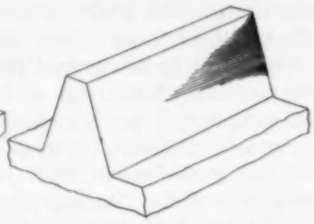


FIG. 10 Move Gear away from Pinion

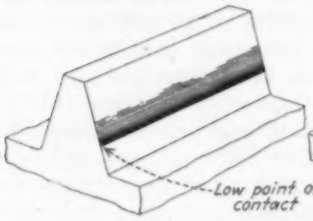


FIG. 11 Move Pinion away from Gear

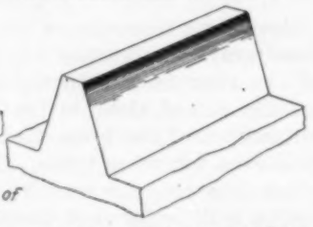


FIG. 12 Move Pinion toward Gear

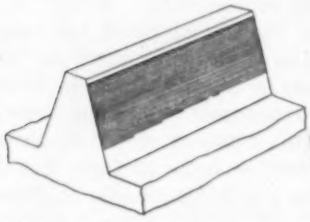


FIG. 13 A Correct Bearing

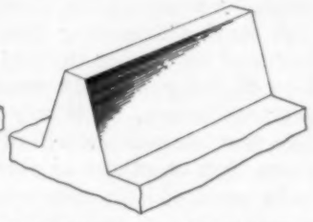


FIG. 14 Move Pinion toward Gear, and move Gear toward Pinion

FIGS. 9 TO 14. BEARING ON GEAR TEETH

is made in the angle of shafts upon which they are mounted. Gears cut without backlash cannot be operated at 90 degrees.

A mean allowance of 0.008 in. has been adopted; gear and pinion each being cut 0.004 in. under the calculated tooth thickness. However, owing to necessary working limits, also to changes due to hardening, this allowance cannot be strictly maintained and will vary in the finished product from 0.005 in. to 0.020 inch.

General Procedure

Backlash cut in bevel gears cannot render them noisy if they are assembled to a proper *bearing*. Gears operating with too much backlash are usually noisy—not on account of their excessive backlash, but by reason of their being out of their proper position. Gears cut with 0.100 in. backlash and operating with 0.100 in. backlash will be satisfactory. The gear should be placed according to bearing—not to backlash. Under full load the ideal bearing is the full length of the tooth. On account of a slight distortion common to all automobile axles, gears should be set with this bearing somewhat toward the small end of tooth, the amount depending upon stiffness of axle construction. As previously explained, this condition is obtained mainly by the adjustment of the gear.

Note bearing along gear tooth. If the bearing is heavy on the large ends of teeth (Fig. 9), move gear toward the pinion. If the bearing is too heavy on the small ends of the teeth (Fig. 10), move gear away from pinion. Under the same load as will be applied to the axle in service, the bearing should be even the entire length of the teeth, and if this load is applied, gear should be so adjusted that this contact exists.

If a lighter load is applied in test, the bearing must be heaviest on the small ends of the teeth to allow for spring in the axle or for lift of pinion. This allowance depends upon the relation of the loads applied, and upon the construction of the axle. The position of the gear practically controls the bearing along the teeth. Moving the pinion to or from the gear has the same effect, but to a less extent.

After a proper bearing is secured along the tooth, the next problem is to bring the pinion into a position that will insure the engagement of equal pitches. After this again adjust the gear, if necessary, to restore the proper contact *along* the tooth if the pinion has been moved far enough to alter this. The proper position of the pinion is evidenced by the position of the contact on the profile of the gear tooth as follows: When the engaging pitch of the pinion is greater than the pitch of the gear, the bearing along the gear tooth runs toward the bottom of the gear tooth (Fig. 11). If the gears are operated for any length of time, extreme wear will take place at this point, due to the interference of the tops of the pinion teeth, which will show a heavy bearing (Fig. 5). This condition indicates that the pinion must be moved from the gear until the contact just begins to leave its lowest point. Contact should, under ideal conditions, just reach this low point on the gear tooth, *but should not be concentrated there.*

When the engaged pitch of the pinion is less than the pitch of the gear, the bearing along the tooth runs toward the top of the gear tooth as illustrated by Fig. 12, and is concentrated at the flank of the pinion teeth (Fig. 6), causing interference at this point. To correct this, move pinion toward gear until the contact just reaches the lowest point of contact on gear tooth.

If gears are cut theoretically correct, the contact will extend from near the top of gear tooth to the lowest point of contact (See Fig. 13); that is, to its effective bearing above pitch line. The location of the low points of contact on the gear teeth depends upon the diameter of the pinion, the proportion of the teeth and angle of obliquity, and must be found by experiment for each particular ratio. The contact on gear tooth should begin at this point and should be made to extend up to the tooth as far as possible without drawing it away from its lowest point.

With an undertsanding of the foregoing points, no special explanation is necessary regarding Figs. 2 and 3. For ratios such as shown, the position of the gear practically controls the bearing along the tooth, and the position of the pinion, the bearing on the profile of the tooth. A movement of the gear affects the profile bearing to a less extent, as does a movement of the pinion affect the bearing along the tooth. For miter gears (ratio 1 to 1) the effect of a movement of either is equal in each respect.

It is often possible to properly locate a pair of gears by one movement of either gear or pinion. Suppose, for example, that when the gear is first painted, the bearing shows slightly heavy on large ends of teeth, indicating too much backlash, and the bearing is out

toward the points of the teeth, indicating pinion too far away from gear. (See Fig. 14.) See also Fig. 7, in which case drawing the pinion away from the gear may drop bearing to its proper place and bring it across the full length of its tooth.

By simply moving the pinion toward the gear, the contact is brought farther down the profile of the gear tooth, and at the same time owing to the amount of backlash being reduced somewhat by this movement, the bearing will travel farther down toward the small end of the tooth. However, if this pinion movement has not changed the bearing *along* the tooth a sufficient amount, the gear must be moved toward the pinion.

The Block Test

The usual practice of mounting the axle on a block and adjusting the gears to their quietest position, under load, will not give the satisfactory results. Noise cannot be used as a basis for gear adjustment under these conditions. Aside from this, the operator is working entirely in the dark as regards the relative position of the gears and after testing a few axles, becomes tone deaf.

After assembling, the axle may be mounted on a block or if pressed steel construction is used, the best plan is to mount the carrier in a saddle or any convenient arrangement to run gears under load. The proper load to apply should be at least one-third the maximum power to be applied to the axle when under the car, at a speed corresponding to twenty miles per hour.

After attaining the desired bearing, the pinion may be readjusted to the quietest point at which it will operate *without disturbing the bearing attained.*

Exceptional care is ordinarily taken in the manufacture of the straight tooth gears to avoid cross bearing, so when cross bearing is found to any extent detrimental to their operation, it may be safely assumed that the trouble is due either to the machining or to the distortion of the axle or carrier.

It is difficult and generally impossible to quiet a pair of gears (straight tooth) if the axis of pinion is not on a plane with that of the gear. This is especially so when the bearing is heavy on the large end of the tooth on the drive and on the small end of the back-up or reverse drive. This bearing indicates that the axis of pinion is higher than the axis of the gear. A slight indication in the opposite direction is usually beneficial. For satisfactory results, the pinion axis should not be more than 0.001 in. above or 0.004 in. below the axis of the gear although 0.000 in. above and 0.005 in. below is better practice.

With spiral bevel gears it is impracticable, for the present at least, to furnish gears which will show a full length bearing on each side of the tooth. This is due to the nature of the spiral tooth which changes the position of its bearing, due to conditions of hardening. The nearest approach to a full bearing which can be maintained is a two-third length from opposite ends of the tooth. In this connection, care must be taken not to cramp the action of the gears in an attempt to secure a front end bearing in case this cross bearing is found heavy toward the large end of the tooth on the drive side. *At least 0.004 in. backlash should be obtained.*

On left-hand spiral gears the tendency is for the bearing to be found, when crossed, heavy on the large end of the drive and for right-hand gears heavy on the small end of the drive. The drive side of the tooth should always be favored in adjusting for bearing; the reverse side is usually of relatively small importance. When the gears show an acute cross bearing in either direction, there is little chance of getting them quiet, and continued re-adjustment under the car is usually a mere waste of time. This is one error that cannot be compensated for by any position of the gears.

When we have gears of an even ratio such as 48 to 12, 52 to 13, 56 to 14, 45 to 15, etc., the bearing along the gear teeth will be uneven if the pinion runs out the slightest amount. Under such conditions the bearing will begin, say at the large end of the tooth and track across the face until it is at the small end of the tooth, then back across the face until it is again heavy at the large end. This will occur three times around the gear for a ratio of exactly 3 to 1, four times for a ratio of 4 to 1, etc.

A full even bearing all around the gear cannot be produced commercially *for any even ratio.* Each tooth in the gear engages the same tooth in the pinion at each revoltuion, and any unevenness, particularly in the pinion, will show an uneven bearing. Therefore, when adjusting the gear for any even ratio, an average bearing must be taken for position. Uneven bearing should not be confused with cross bearing.

After hardening, it is not to be supposed that the ring gear can be made to run as true as when soft, therefore some allowance must be made. Provision has been made in cutting the teeth for a reasonable amount of out-of-round, and when making final inspection test of assembled differential and pinion, no particular attention is paid to the running of the gear unless an out-of-round is in evidence. In this event the ring gear should be removed and brought within 0.008 in. on face and diameter. It is evident that gears may be found which run out in excess of these limits without being detrimental to their quiet operation; the arc through which any such runout occurs must be considered.

Bottoming of Teeth

The fact of the teeth bottoming when set together by hand or when gears are operated without backlash is no indication of incorrect cutting. All six-pitch, many five-pitch, and in some cases even four-pitch will show this apparent defect. There is no danger of this bottoming action when gears are properly assembled, that is, with a proper amount of backlash, or more properly expressed—with a full face bearing.

Reducing the thickness of the teeth for backlash allows the pinion to drop deeper into mesh with the gear, which drop in many cases amounts to the total bottom clearance of tooth. In operation, however, the pinion should be held out of this engagement. A properly assembled pair of gears cannot bottom, no matter how thin the teeth may have been cut.

Bevel gears are cut to operate at a shaft angle of 90 deg. The axle should be machined in accordance with this. If the axle is less than 90 deg. the amount of backlash in the gears is necessarily reduced; if greater than 90 deg. the backlash is increased, that is, when maintaining an even bearing along the teeth.

For 14½ deg. teeth, 3.8 min. change in shaft angle affects the backlash 0.001 in. For 20 deg. teeth, 2.7 min. makes the same change. For satisfactory results the proper shaft angle should be maintained within 5 min. plus or minus for the 14½ deg. teeth and within 3 min. for the 20 degrees.

Although the foregoing plan of gear adjustment may

appear extremely simple, it requires a little practice before an operator becomes proficient in its use. For this reason a record of setting made should be kept until operator can definitely foretell the result of a given position for the gear. As each axle is adjusted, make a record of axle number, position of bearing along the teeth on both drive and reverse, profile bearing on each side of teeth and amount of backlash. Opposite these data should be noted the performance of the axle under the car.

In a short time the operator will begin to see what is required to produce quiet axles, and will detect axle distortion if it exists and know how to counteract or to allow for it. The desired bearing for each particular type of axle must be found in this manner.

The Road Test

It is quite possible that the position of pinion will sometimes require a slight adjustment after the axle is under the car, as it is not always possible to locate it with sufficient accuracy according to the bearing. This is generally due to spring in the axle or to looseness in construction, or both. Also, it should be understood that a pinion movement of 0.005 in. in either direction often secures results. This adjustment is usually readily made and should be considered a part of the regular road test. If the axle is noisy after the best position of pinion has been secured, it should never be necessary to move the gear. However, if the gears have been set as directed, and the drive is noisy under car, the best general rule for this is as follows:

If the axle construction is such that the differential bearing supports are weak and have a tendency to spread, move the gear up towards the pinion, reducing the amount of backlash. If the principal weakness is in the third member, or in the pinion sleeve, or is in fact anything which will allow the pinion to lift, change its axial position or whip, move the gear away from the pinion, increasing the amount of backlash, or have the gear cut specially to meet this condition. Adjusting the *gear* under car is poor practice.

To adjust gears under the car, remove oil and clean gears with gasoline. Paint the gear all around with a mixture of red lead and oil and leave off rear cover so that gears are exposed. A short run, say five or six miles without lubricant, will not injure the gears, although bearings should be lubricated. As a preliminary test, the rear end of the car may be jacked up in the garage and show bearing on teeth by applying brakes.

Adjusting gears at random in an endeavor to locate their quiet operating position is poor practice, particularly with spiral gears, as rapid wear in both gears and bearings is very liable to result. *Get the bearings.*

In gears operating with 0.008 in. backlash, a pinion lift of 0.005 in. should not be exceeded, as this barely leaves operating clearance. If the lift of pinion exceeds this amount, the error may be taken care of to a certain extent in the cutting of the gear up to about 0.015 in. If beyond this point, there is little hope of securing quiet gears. For spiral bevel gears it is especially necessary to check for changes in the axial position of pinion, particularly between the drive and the reverse.

Before a new design of axle or carrier is manufactured in quantities, a sample should be assembled and subjected to a static test, in order to locate any weakness which may exist in its construction. The principal parts to be checked are the end movement of differential and of pinion, the lift of pinion and the spread of differential bearings. The latter is of special importance if cup and cone or taper roller bearings are used.

In long third member construction the distortion of drive shaft and torque tube is of importance. The load applied to the pinion shaft should represent the maximum power of motor at 1,000 r.p.m., carrying this power through the lowest transmission gear, usually 3½ to 1. This means calculating the torque load from the full power of motor at 300 r.p.m. of the pinion.

Using 36-in. lever on pinion shaft the proper load may be found as follows:

Weight equals 5.833 × horsepower.

In any other length of lever we have—

$$\text{Weight} = \frac{210}{\text{Length of lever in inches}} \times \text{horsepower}$$

From this may be deducted one-half the weight of lever.

The possible effect of a change in the gear ratio must not be ignored when conducting a static test or in the event of any trouble being experienced with the axle. An axle perfectly satisfactory with a ratio of 3 to 1 will possibly give an enormous amount of trouble if a 4 to 1 gear is applied. The difference between a 3 to 1 and a 3½ to 1 reduction is very noticeable from a noise standpoint. Axles should be designed to meet the requirements of the lowest reduction to be employed, and upon general principles have the least reduction possible.

General Precautions

Never allow gears to be assembled in a cramped position. The gear should revolve freely after all bolts and adjustments are set. Be sure that the thrust end of the differential is seated against the thrust bearings, otherwise the gear may change its position in service. A partial turn of the adjusting nut opposite the thrust bearing is generally advisable, so as to avoid any possibility of cramping the bearing. This, of course, does not apply to cases when conical or radial bearings are employed.

Profile bearing should, if anything, be placed a little high, rather than low, especially for left-hand spiral gears and right-hand pinions, owing to the tendency of the pinion to crowd a little forward on service. When replacing gears for service, examine bearings carefully; worn, chipped or pitted bearings should be replaced. Outer ball races must be a snug fit in the bearing holes, and inner races must be a snug fit on shafts or differential hubs.

Make sure that all parts which go on the inside of housing are thoroughly clean. Any chips, grit or other hard substances grind out the bearings and gears very quickly. A lost nut or lockwasher may necessitate a new set of gears. All studs and nuts to be a good fit in threads so as to hold gears and bearings in place. If these are loose the gears will vibrate.

The plan of adjusting bevel gears herein outlined is not an experiment. It is a proper method, based upon the true nature of tooth contact. Some trouble in its application is to be expected. The operator must become familiar with the causes underlying changes in tooth contact and apply this knowledge to the particular axle under consideration. When mastered, uniform satisfactory results can be guaranteed.

A complete understanding of the principles given in this article will enable the operator to either locate the gears in a satisfactory position or to determine why they cannot be so located.

Machining a Case Hardened Mack Crankshaft

Hard and Long-Wearing Surfaces Secured by Case Hardening—Straightening, Turning and Grinding Operations—Balancing, Final Straightening and Inspection

BY FRED H. COLVIN
Editor, AMERICAN MACHINIST

THE engineers of the Mack motor found it advisable to use case hardened carbon steel crankshafts in place of special alloys, on account of the extremely hard surface produced on the pins and bearings.

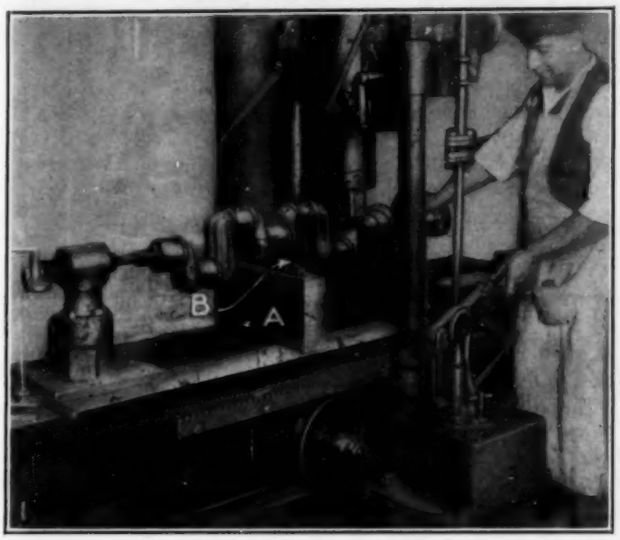
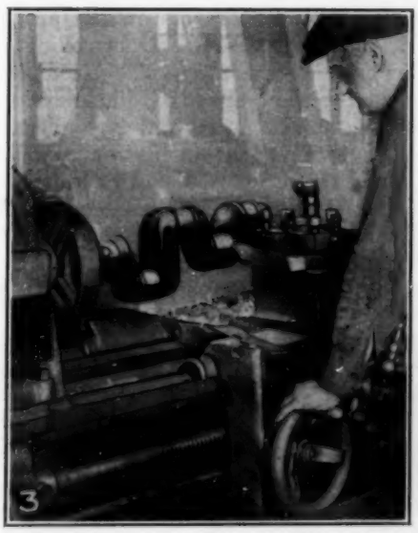


FIG. 1. STRAIGHTENING A CRANKSHAFT FORGING. FIG. 2. SPRINGING IT SIDEWAYS



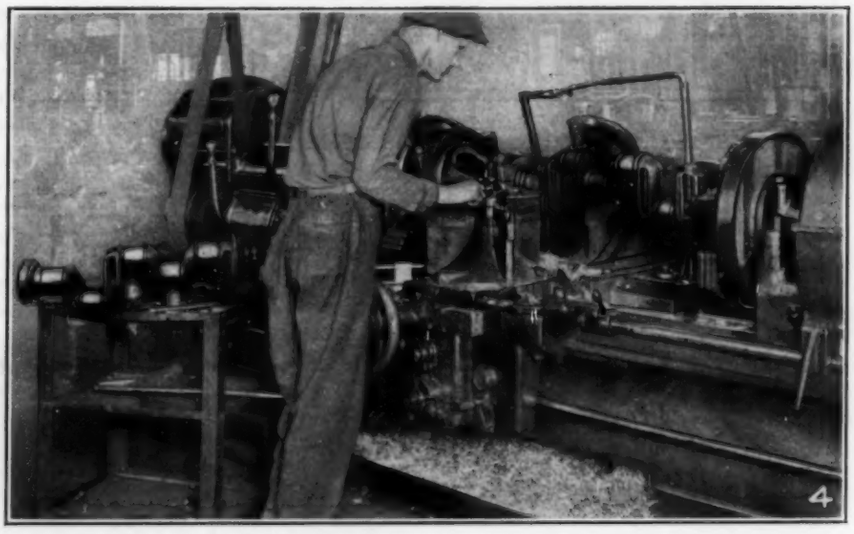


FIG. 3. ROUGH-TURNING THE BEARINGS. FIG. 4. ROUGH-TURNING THE CRANKPIN

These shafts have given excellent results as the case-hardened surfaces seem to resist wear remarkably well and there has been no trouble from breakage, owing to the size of shaft used. It is interesting to note that at least one of the builders of high-grade passenger cars is adopting this same method with extremely satisfactory results.

The forgings are very carefully inspected, after which both ends are centered and the crankshaft straightened. Ample provisions are made for straightening, as can be seen in Figs. 1 and 2. The crankshaft is revolved on the centers shown but the centers do not, of course, bear the brunt of the straightening pressures. Blocks are provided as at *A*, Fig. 1, and wedges such as *B* are slipped in place between the blocks and the crankshaft, so as to take the stresses due to the application of hydraulic pressure by the pump shown. Fig. 2 shows the shaft being sprung in the center while in Fig. 1 the end web is under pressure.

Then comes the turning of the main bearings and the crankpins, as can be seen in Figs. 3 and 4, both American and LeBlond lathes being used for this purpose. After the bearings have been turned, the crankshaft is carburized and straightened again, should the latter be

FIG. 5. TURNING AND FACING FLANGE.

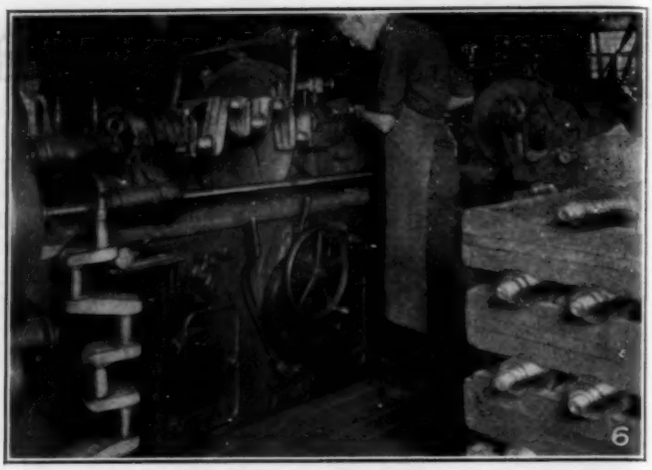


FIG. 6. ROUGH GRINDING THE PINS

found necessary when it comes from the carburizing furnaces. Then the flanges are rough-turned and faced as shown in Fig. 5 and the thread end and gear seat are roughed out as is the ball race. The thread end is

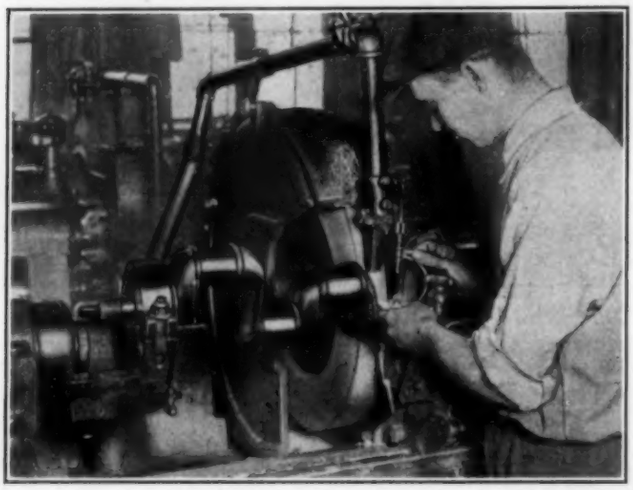


FIG. 7. MEASURING THE PIN DIAMETER

then cut off and recentered and the shaft is ready for hardening.

This means heating to 1,600 deg. F. and quenching. Then comes the inspection for hardness and the annealing of the flange of the thread end. Sand blasting is now in order to remove the scale and the shaft is then straightened very carefully, the tolerance being 0.007 inch.

The flange end which has been previously annealed is now finish-turned as is the gear seat and the end to be threaded, after which the threads are cut. The shaft is then recentered for grinding and the rough-grinding of the main and crankpin bearings now takes place.

In Figs. 6 and 7 are shown two of the grinding operations on different shafts. Different types of grinders are employed, as can be seen. The rack at the right in Fig. 6 shows a convenient way of stacking crankshafts in a compact manner and at the same time, in such a way that they will be perfectly safe against damage to the round surfaces. Stacking is accomplished by the use of wooden frames with notches cut in the proper positions so as to keep the crankshafts from rolling in either direction. As can be seen in Fig. 7, the micrometer is used for measuring the crankshaft diameters.

The crankshafts are then balanced and straightened as shown in Fig. 8, substantial balancing ways and a convenient screw press being used for this purpose. The large grinding stand at the rear enables sufficient metal to be ground off the heavy portion of the shaft to secure the desired balance.

All the finish-grinding of pins and bearings now takes

FIG. 8. BALANCING AND STRAIGHTENING THE SHAFT

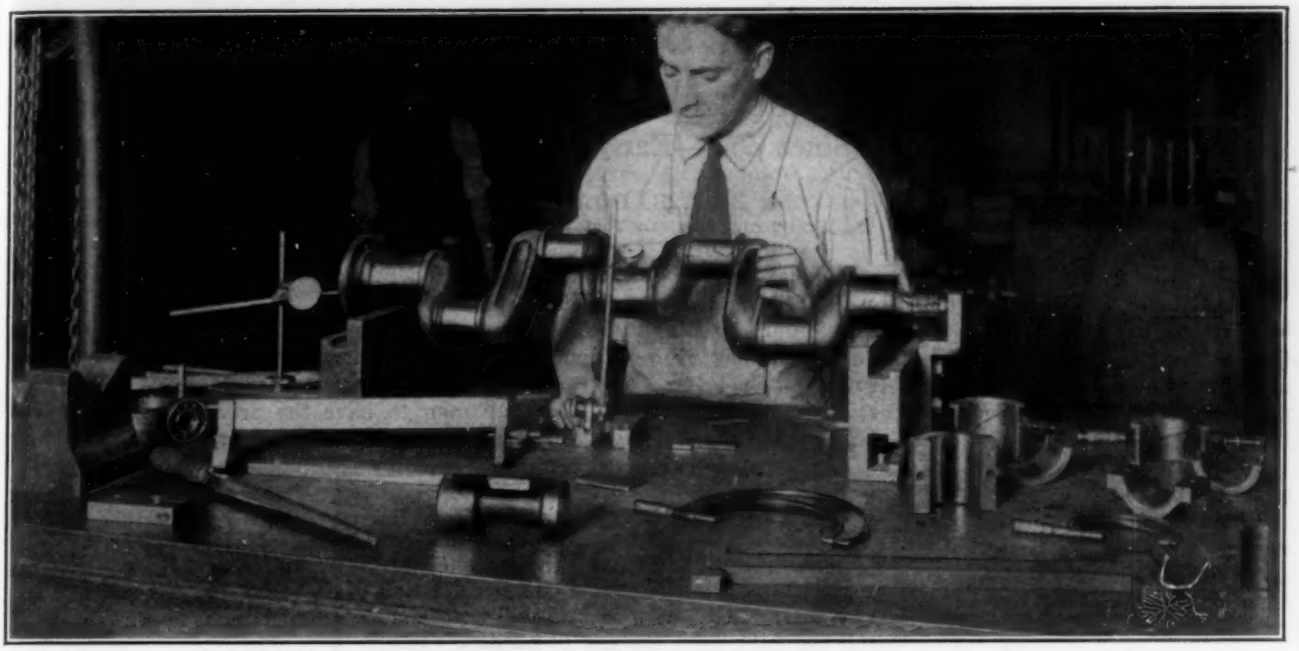


FIG. 9. THE INSPECTION BENCH

place together with the drilling and reaming of the flange holes and the milling of the keyway. The ball race is finish-bored and the sides of the flange are then faced so as to insure a true-running flywheel.

Then comes the final inspection of all machining operations, as shown on the bench in Fig. 9. The inspector is provided with suitable supporting stands and all kinds of testing instruments for inspecting not only diameters, but alignment of the shaft, shoulder distances, length of bearings, and the truth of the flange at the end. Care in crankshaft work has much to do with the successful operation of a motor and every precaution is taken to insure satisfaction at this point.

Selling the Salesman

BY DWIGHT DONALD

An editorial on page 228 of AMERICAN MACHINIST, entitled "For Your Own Good, Listen to the Salesman," demanded a second reading. I agreed with it on the first reading and I was still in accord with it after the re-reading—for it held arguments based on conditions that cannot be denied by any broad-minded business man.

Withal it was a strong plea in the interest of "selling the salesman," who today, during this time of extreme business depression, is needed more than ever by the producer of goods. The manufacturer does need the visiting salesman as a source of information as to where he can purchase equipment capable of turning out a product of high quality at the lowest possible cost. On the other hand, the salesmen in his own organization are indispensable in disposing of the material which he produces.

Nevertheless, the editorial title persists in coming before me in the form, "Salesman, for Your Own Good, Listen." By this transposition I would not seem to recommend that the salesman listen interminably to the general gossip of some purchasing agent or particularly sociable clerk whose time is hanging heavily on his hands. Admitting that sociability necessarily enters in the selling game, the interviewer has an hourly value to his employer and an hour spent in idle gossip is sixty minutes added to the cost of buying and selling.

Of course, the salesman must listen to sideplays and endeavor to learn and remember the hobbies of his prospect, so that he may cultivate as close a friendship as possible, for acquaintance is rated as a high percentage in successful dealing with the buyer. However, as the salesman listens let him decide whether he is talking with one who is in a position to make or recommend purchases, and in any instance to judge when he has reached the peak in his effort to sell. Don't let the interview reach an anticlimax each time, so that the prospect comes to regard the salesman as an unprofitable pest. If the buyer is affected with an unusual degree of sociability (some salesmen will be dubious about the existence of such a species), he invariably enjoys a relation of his own experiences, rather than having to listen to the life history of the salesman or a discourse on how he put over the last big sale.

Today there are many salesmen, be they on straight commission or salary, who appear to have the spirit, "The world is not buying, anyway"—and therefore consider each stop as a place to rest and spin a few yarns, with the excuse that they are doing missionary work.

Oh, by the way, I too have been of that honorable profession of those who travel from town to town and from desk to desk. Now that I am stationed back at the plant, and have occasion to meet many of the boys at my own desk, I am decidedly not the type of "gentleman" (by courtesy only) who tries to get back at the world for some unpleasant experience he may have suffered at the hands of some sixth assistant purchasing agent, recently promoted from office boy.

With this explanation I am sure my remarks will be accepted by our salesmen friends as suggestions rather than harsh criticism.

But, salesmen, keep on dispensing your optimism which we all admire and need; continue to spread the telling story of your product; know when you are through, and don't outwear your welcome—and come again! We need such "ambassadors of commerce."

Selling on Quality

Price Concessions Easier for the Salesman but Dangerous to the Builder—Foreign Competition Stronger Since War—Early Action on Standards Essential

BY J. B. DOAN
President, American Tool Works Co.

SELLING on a declining market is a hard job no matter what policy is adopted by the seller. Most buyers of machine tools are just as familiar with the business situation as are the sellers, and they are not slow to press their advantage. As a result the seller may be led or forced to price concessions, particularly if his financial condition is weak. Such a course is too often the first step to practical business suicide.

When a purchaser discovers that he can beat down a salesman's price, the salesman's position becomes an unenviable one. A shrewd buyer will go at him with statements or hints of a more or less veiled character, to the effect that his competitor has shaded his price or offered certain extra equipment. The final price in such a situation is largely dependent on the ability of the buyer to play on the credulity of the salesman and his anxiety to make the sale no matter what the cost.

A SALE MADE on a quality basis at list price is well worth many times the effort expended in making one on a cut-price basis.

The customer is satisfied and will be easier to sell the next time, instead of harder. The salesman has gained confidence from his success in selling on a straightforward business basis and will tackle his next prospect with added vigor. The manufacturer has made a fair profit on the sale and can afford to maintain and improve the high quality expected of his product.

Aside from any consideration of the ethics of price cutting, the salesman's knowledge that his house will permit him to make concessions never fails to extract some of the drive from his efforts to land orders at list price. Under fire both from his competitors and from his customer, it takes a man with considerable backbone to resist the combined pressure and sell his product solely on its merits.

BUYING PRODUCTIVE CAPACITY

On the other hand, if he has no discretion in the matter of price, but must sell at list or lose the sale, the salesman can concentrate on impressing his customer with the fact that he is buying productive capacity which will make profits, rather than so many pounds of manufactured iron and steel. In these times even the best salesman needs every bit of concentration he can muster to convince a prospect on this basis. His chances of success are much reduced if the distracting thought is present in the back of his mind that if he fails to sell on quality and service ability he can fall back on price concessions.

A good many years ago we had a convincing demonstration of the truth of the assertions just made. One of our best salesmen was working the southern territory during a period not unlike the present, and price-cutting was going on everywhere. Our man, whom we may call Williams because that wasn't his name, was not getting results. We knew he was up against a tough proposition but he had been in the same fix before and had made good. His reports were pessimistic, business was rotten and nobody would even listen to sales talk at list prices.

Finally an order came in from a customer to whom Williams had quoted our dealer's price. This was contrary to custom, but not to orders, as Williams was a big enough man to have the privilege of using his own judgment about prices in emergency cases. But this was not an emergency case. His action was decidedly unjustified by conditions, and so fifteen minutes after the order came in this telegram was on its way to Mr. Williams. "Absolutely maintain prices. Judgment removed from you."

The telegram had the desired effect. Without the price concession crutch to lean on Williams pulled himself together, put his old enthusiasm into his work and commenced sending in list price orders again. That one incident was enough for us. It established a sound principle which has been maintained ever since.

While we are talking about maintaining prices I want to bring out one more point—the customer's attitude after he has succeeded in beating down a salesman or a manufacturer. At first he is very well pleased with his own sagacity and business acumen, but before long he can't help wondering whether he really beat the other fellow down as far as he might have. He begins to have doubts as to whether he was actually so very smart after all, and he usually winds up by coming to a hard and fast decision to be sure to reach the bottom the next time he has to buy anything from that company. He knows their weakness and he can be trusted to make the most of it. Having once forced a price concession his confidence is shaken and he will never be quite satisfied in a future deal no matter how favorable the terms he gets.

But there is another side to the picture. Everyone knows that comfortable, soul-satisfying feeling which comes with the possession of anything of first quality. It makes no difference what it is, an automobile, a fine house, a good coat, a high-grade machine tool, the feeling is there just the same. Even though part of the feeling may be due to the complacency of owning a better article than the other fellow, there is at the same time the solid conviction that quality goods are cheapest in the long run and produce the best results.

Another phase of the same psychological phenomenon is the almost universal desire to improve one's condition of living, keenest perhaps in Americans. Take your own experience with motor cars or perhaps your neighbor's. The chances are that you begin with

a second-hand car or the cheapest one now available. It is ten to one that when you reached the point of getting another one you selected as much more expensive and inferentially better a make as your pocketbook would stand. If you stuck to the same make the odds are just as good that the manufacturer had improved his product sufficiently in the time between your two purchases so that the same effect was attained.

The desire for something better is a moving factor in American ambition and success and can well be played upon by the wise salesman. If he has the right stuff in him he can hammer away at this side of the customer's stronghold and while it may not be so vulnerable as the price side it can be scaled.

A sale made on a quality basis at list price is well worth many times the effort expended in making one on a cut-price basis.

The customer is satisfied and will be easier to sell the next time, instead of harder. The salesman has gained confidence from his success in selling on a straightforward business basis and will tackle his next prospect with added vigor. The manufacturer has made a fair profit on the sale and can afford to maintain and improve the high quality expected of his product.

It should be obvious that selling on quality is utterly impossible unless the quality actually exists. The builder must make certain that his machine is at least as good as any other of the same type on the market, and better than the great majority of others. He must keep constantly at work to improve the quality and it is well to keep the field informed of improvements as they are made. His salesmen must know that the quality is there, and where and why and how, and must be so proud of it that their enthusiasm is contagious.

As I stated above, quality can only be maintained if a fair price is secured for the product. The two are mutually dependent and it is a hopeless job to try to build quality tools if they are to be sold at a loss. It simply can't be done very long. Either the quality suffers or the builder goes broke.

We feel that not only must the shop be manned by the very best machinists but the equipment must be thoroughly up-to-date. In our own plant we have taken advantage of dull times to go over every machine and either repair or replace it. In our radial drilling department, for instance, we sold the twenty-four machines of different sizes that had been there for several years and replaced them with seventeen new ones from stock. The new machines take up much less room and consequently cut down the departmental overhead, but in addition they are so much more efficient that the seventeen will turn out more work than twenty-four did before.

While we are talking about shops and equipment it might be well to say that this country no longer has the monopoly of methods and tools that it had before the war. Then we could build a quality tool here as cheaply as an ordinary one could be built in Europe. We understood production methods and interchangeable manufacture; they did not. But the war has changed all that. The British and French inspectors learned a lot in our munition plants and they are turning their knowledge to account. Then, too, there are many plants, both in England and on the continent, which are thoroughly equipped with the most modern machinery. We certainly sold a lot of it abroad during the war and our Army left a whole lot more behind them. It will take all of our famous ingenuity to keep ahead and even then we will be hard pressed if we don't get started on standardization of minor parts.

There is no reason on earth why every manufacturer of machine tools should insist on having his own pet systems of standards for such things as T-slots, spindle noses, handwheels, ball cranks, etc. The differences are so small as to be insignificant, but they add tremendously to production costs.

There is keen interest in these matters abroad. England, France, Germany, Holland, Belgium and others are studying standardization, and Germany and Holland have already issued accepted standards for certain parts. We can't afford to let them beat us at this game. If they do we shall soon have to face cheaper imported tools in our own markets than are coming in now.

Suggestion for Herringbone Gear Standards

BY N. LEERBERG

The action of the American Gear Manufacturers' Association in standardizing herringbone gears is a very commendable move. But standardization should in all cases take simplicity into consideration, especially when such standardization is based on arbitrary or empirical data. The table of "Enlargements for Pinions with 17 Teeth or Less," published on page 330 of AMERICAN MACHINIST, is such a case. This table is calculated from the well known interference formula for 20 deg. standard addendum teeth:

ENLARGEMENTS FOR PINIONS WITH 17 TEETH AND LESS

No. of Teeth	Diametral Pitch												
	10	8	6	5	4	3.5	3	2.5	2	1.75	1.5	1.25	1
7	0.120	0.150	0.200	0.240	0.300	0.340	0.400	0.480	0.600	0.680	0.800	0.960	1.200
8	0.108	0.136	0.180	0.216	0.270	0.306	0.360	0.432	0.540	0.612	0.720	0.864	1.080
9	0.096	0.120	0.160	0.192	0.240	0.272	0.320	0.384	0.480	0.544	0.640	0.768	0.960
10	0.084	0.104	0.140	0.168	0.210	0.238	0.280	0.336	0.420	0.476	0.560	0.672	0.840
11	0.072	0.090	0.120	0.144	0.180	0.204	0.240	0.288	0.360	0.408	0.480	0.576	0.720
12	0.060	0.076	0.100	0.120	0.150	0.170	0.200	0.240	0.300	0.340	0.400	0.480	0.600
13	0.048	0.060	0.080	0.096	0.120	0.136	0.160	0.192	0.240	0.272	0.320	0.384	0.480
14	0.036	0.046	0.060	0.072	0.090	0.102	0.120	0.144	0.180	0.204	0.240	0.288	0.360
15	0.024	0.030	0.040	0.048	0.060	0.070	0.080	0.096	0.120	0.136	0.160	0.192	0.240
16	0.012	0.016	0.020	0.024	0.030	0.034	0.040	0.048	0.060	0.068	0.080	0.096	0.120
17	0.002	0.002	0.002	0.002	0.002	0.004	0.004	0.004	0.006	0.006	0.008	0.010	0.012

$$x = \frac{1 - 0.05849\,N}{P}, \text{ or}$$

$$\text{Enlargement} = \frac{2(1 - 0.05849\,N)}{P}.$$

The herringbone gear has a stub tooth, however, and does not need this amount of enlargement to avoid interference. The object of the enlargement is mainly to give a free cutting action to the hob. There is, therefore, no need of the rather complex dimensions given in the table. The writer has, consequently, rearranged the table as given above, and strongly recommends its consideration.

In this table the last column is changed to multiples of 0.120. The dimensions in the remaining columns are in inverse ratio to the diametral pitch. It will be noticed that the values in each vertical column are multiples of 0.012, 0.015, 0.020, 0.024, 0.030, 0.034, 0.040, 0.048, 0.060, 0.068, 0.080, 0.096 and 0.120 respectively. All dimensions are even so that the addendum may be dimensioned without running into four decimal places. The table agrees closely with the original table and is more commendable for practical use.

Calite—A New Heat-Resisting Alloy

By G. R. Brophy

Metallurgical Engineer, Industrial Furnace Department, General Electric Company

A freshly cut surface of aluminum, like all metals, will show a bright lustrous surface, but after a very short time in the atmosphere becomes dull. On longer exposure little change takes place in this strongly adherent coating. This is recognized as a protective coating of oxide. Aluminum when alloyed in solid solution with other metals, still retains this property of oxidizing readily and lends it to the alloy.

Advantage was taken of this property a few years ago when calorizing was developed. This process consists of coating metals with aluminum at high temperature, actually forming a surface alloy which is highly resistant to oxidation at high temperature, and to many forms of corrosion. Calorizing is not suited for work above 1,832 deg. F., due to the rapid diffusion of aluminum and the consequent lowering of the surface aluminum content to the point where breakdown under oxidation occurs.

Properties of Iron and Aluminum Alloy

A homogeneous alloy made by melting aluminum with iron naturally will show no such diffusion on subsequent heating, and provided the aluminum content is sufficiently high, the alloy will resist oxidation at temperatures nearly up to its melting point. Unfortunately, on repeated heating and rapid cooling, or uneven heating, these alloys crack badly and no homeopathic doses of any third metal tried—and nearly all were tried—helped this condition. The hot metal when the least moisture touched it acted like hot glass, flying to pieces.

The low expansion of high nickel steels, together with the fact that aluminum and nickel form a high melting compound, led to investigating the promising ternary alloys of aluminum, nickel and iron. Therefore, keeping aluminum at a minimum and substituting nickel for iron in various percentages, a series of alloys was obtained which showed increasingly good properties. However, when nickel reached 15 per cent the alloy was soft and lost nearly all its resistance to oxidation. This was probably due to the formation of the high melting compound corresponding to the formula NiAl, which, while highly resistant to oxidation itself, robbed the iron of its protection and allowed the iron to scale badly. Further additions of aluminum and nickel in proportions other than that of the above compound, finally gave an alloy which was strong, would stand shock, hot or cold; could be quenched repeatedly; and was highly resistant to oxidation. A few further refinements gave the alloy which was finally adapted and which we call calite.

Manganese and silicon above 0.75 per cent both tend to decrease resistance to oxidation, but with care in melting no trouble is experienced. Carbon increases brittleness and should be kept as low as possible and easily runs under 0.05 per cent. On account of the ease with which SiO_2 slags with aluminum, the melting must be done in a basic furnace. Also the ladle must have a basic lining.

Basic Heroult-type furnaces are used with good success. Steel scrap is first melted down and decarburized; slag is removed and nickel is added and new slag made. When all is thoroughly deoxidized, the final slag is removed and scrap calite added to the extent of 25 per cent of the melt and dissolved. The melt is then poured into a preheated ladle containing the required amount of molten aluminum. As this alloying takes place, an exothermic reaction occurs of sufficient intensity to dissolve additional scrap, and up to the present scrap amounting to 15 per cent of the melt has been dissolved with sufficient residual heat to necessitate holding in the ladle several minutes. The ladle is bottom poured so that the time of holding allows all oxide to float and nothing but clean metal to be poured.

Calite resists oxidation up to 1,300 deg. C. (2,372 deg. F.), but 1,200 deg. C. (2,200 deg. F.) is recommended for indefinite service. The protective oxide formed is tight and does not snap off even on quenching from high temperatures. Quenching after 100 hr. at 1,200 deg. C., calite lost but 0.03 g. per square centimeter exposed, while the best heat-resisting base metal alloy other than calite lost 0.56 g. under the same conditions. The same samples were run at 1,300 deg. C. for an additional 25 hr. Calite lost 0.003 g., the other 0.09 g. per square centimeter exposed. From these figures it appears that calite is twenty times as resistant at 1,200 deg. C. and the only base metal alloy to stand at temperatures higher. At 900 deg. C., or ordinary operating temperatures, the loss per square centimeter was measured in $\frac{1}{10}$ mg., or for all practical purposes, no loss.

Calite is practically noncorrosive. Samples have been polished and run in a spray of saturated sea salt solution at 100 deg. F. for 200 hr., and at the end of this time still retained the perfect polish.

Twenty-five per cent sulphuric acid dissolves calite rapidly; hydrochloric acid slowly and nitric hardly at all. Forty-eight hours in 25 per cent nitric acid, the metal lost 0.0004 g. per square centimeter exposed. Acetic acid has no effect. Molten carbonates, chlorides, nitrates, cyanides, Pb, Zn, Sn, type metal, sulphur and sulphur vapor do not attack calite. SO_2 gas at 900 deg. C. has no attack. Fluxes such as cryolite, borates and silicates attack calite rapidly.

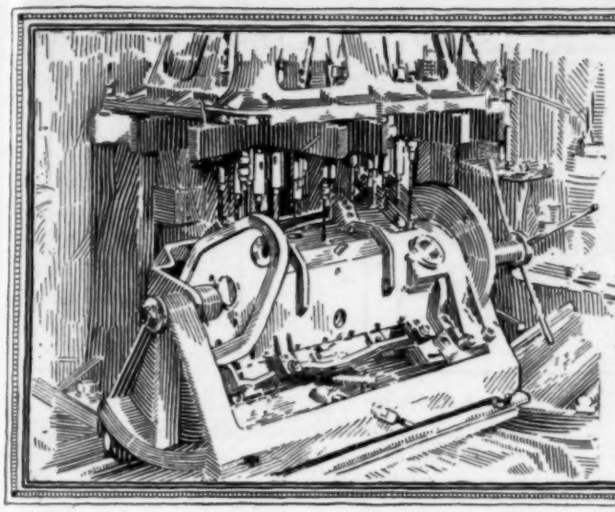
Physical Properties of Calite

In general, the physical properties are as follows:

Melting point, deg. F.	2,777
Softening temperature, deg. F.	2,500
Working temperature, deg. F.	2,200 to 2,370
Specific gravity	7.03
Weight per cubic inch, pounds	0.25
Brinell hardness, annealed	286
Scleroscope hardness, annealed.	40
Thermal conductivity, per cent of iron	25
Transverse stress, 1-in. square bar, pounds per square inch	4,250
Tensile stress, pounds per square inch	36,800

Calite cannot be machined in the cast condition, nor cut with oxyacetylene. Any change of dimension or finish must be done by grinding. It is more resistant to oxidation at high temperatures and will stand higher temperatures than any base-metal alloy tested. Its first cost is low and its operating cost lower than other non-oxidizing alloys. Boxes have been run for 1,500 heat-hours and remained in the best condition and measurements showed no warpage or growth. The oxide coating was no heavier than after the first heat.

Abstract of paper read before American Society for Steel Treating.



Tool Engineering

By
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President and Chief Engineer
Dowd Engineering Company, New York City

Taper Turning Tools Continued — Engine Lathe and Turret Lathe Tooling—Cross-Slide and Turret Taper Tools—Plain and Adjustable Attachments

A SPECIAL taper attachment, useful when a number of different tapers are to be turned, is shown in Fig. 361. This tool is not of the adjustable type, but the taper bar is readily removable so that it can be replaced by another of a different taper. The body of the tool *A* is in the form of a bracket which is attached to the face of the turret. On this bracket a dove-tailed slide *B* provided with a taper gib is mounted. The upper part of the bracket is also dove-tailed and a taper bar *C* is fitted to it. An adjustable gib *D* is provided for this dove-tailed member also.

The angle of the taper is determined by the angularity of the slot *E* which is cut in the taper bar. The back of the slide *B* has a roller in it at *F*, traveling in the slot *E* and thus controlling the angle of the taper. In some convenient place on the headstock of the machine a bracket *G* is fastened, with an adjustable stop *H* projecting from it a distance sufficient to strike the end of the taper bar as shown. The tool *K* is carried in the block *L* mounted on the vertical sliding member *B*. In operation, the turret is brought forward until the bar *C* strikes the end of the stop *H*, at which time the feed is engaged and the tool moves ahead controlled as to its angle by the position of the roller in the slot *E*.

There are some points in this design which can doubtless be improved; for example, the projection of the tool *K* is excessive and the cutting action would be likely to cause it to dig in and chatter. It would be possible to build the entire mechanism in such a way that the tool would not overhang so much, so that there would be less danger of vibration. For light cutting, however, when a number of different angles are to be machined, a tool of this kind would produce good work.

The principle here shown can be applied to other varieties of taper turning tools. It would be possible, also, to make a similar arrangement for boring, although the toolholder and slide might be somewhat changed from the form shown. Another improvement on the same tool would be fitting the toolblock *L* in such a way that it could be adjusted up and down to take different positions on the slide, thus increasing the capacity of the attachment.

When work is long and slender it is difficult to turn it without support; hence a taper turning tool designed for a purpose of this sort should provide the necessary rest for the work. In the work shown at *A* in Fig. 362 a taper is to be cut on the end *B*, as shown by the dotted lines. On account of the length of the bar and the lack of center support, the tool itself must be so arranged that the work cannot vibrate during the cutting action. The body of the tool *C* consists of a bracket fastened to the turret face as shown. At the forward end of this bracket an angular block *D* is located, in order to carry the supporting bushing *E* in which the work is piloted.

The tool *F* is mounted in a block *G* which is fastened to a dove-tailed slide *H*. On the under side of this slide the stud *L* is fixed; and the spring *K* thrusts against this stud and causes the roller *M* to remain in contact with the taper blade *N* along which it travels. The roller is supported in a holder *O* fastened to the top of the slide. The illustration at *P* shows this construction clearly. The taper blade *N* is fastened to a substantial bracket *Q* at the rear of the cross-slide. The latter is firmly clamped in position longitudinally while the work is being done. It would be possible to attach one or more tools to the front of the cross-slide and use them for other operations on the work if necessary. In the present case, however, these tools are not needed as the cross-slide is not in use.

An additional refinement which would probably improve this design somewhat would be to make the bracket *Q* shorter, and provide the cross-slide with a hardened block over which the bracket *C* can slide, thus giving additional support. Changes would need to be made in the design of the bracket in order to provide for a condition such as this. Vibration is eliminated by the support which the work receives in the bushing. For shallow taper work an attachment of this sort is very useful, and if provided with suitable adjustments a number of tapers could be easily turned, and different diameters of work could be supported

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by using different sizes of bushings. An oil cup *R* is used to lubricate the bushings.

Many engine lathes are provided with a taper attachment placed at the rear of the machine and usually adjustable within a limited range. All engine lathes, however, are not provided with an attachment of this kind, although it may be desirable to use one of the machines occasionally for taper work. A simple attachment which can be used for this purpose is shown in Fig. 363.

The work *A* is held in a collet in the usual manner. The regular cross-slide of the lathe is removed and replaced by a special slide *B*. This slide is fitted to the dovetail on the carriage and a block *C* is so fastened that it supports a heavy coil spring *D*. The tool *E* is held at one end of the slide *B* in the proper position with respect to the center of the work. The tapered bar *F* is fastened to the headstock of the lathe, and is machined at *G* to an angle corresponding to the taper required. A block *H* is fastened to the carriage to act as a support for the taper bar and to prevent

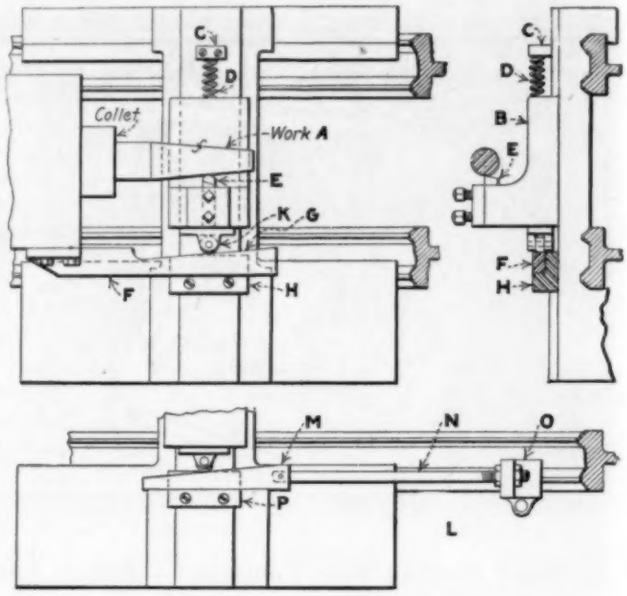


FIG. 363. SIMPLE TAPER ATTACHMENT FOR ENGINE LATHE

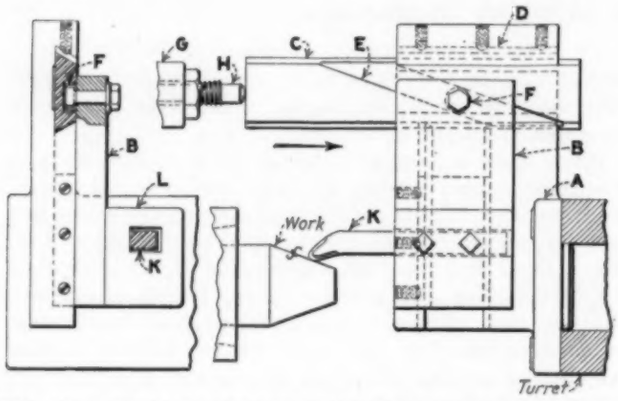
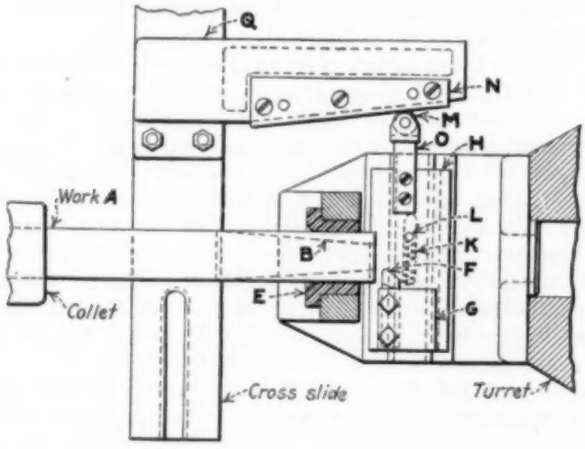


FIG. 361. SPECIAL ATTACHMENT FOR TURNING TAPERS



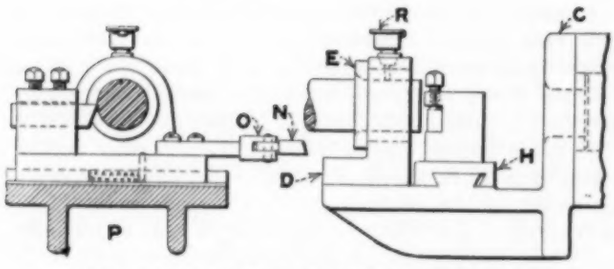


FIG. 362. TAPER GENERATING TOOL WITH SUPPORT FOR WORK

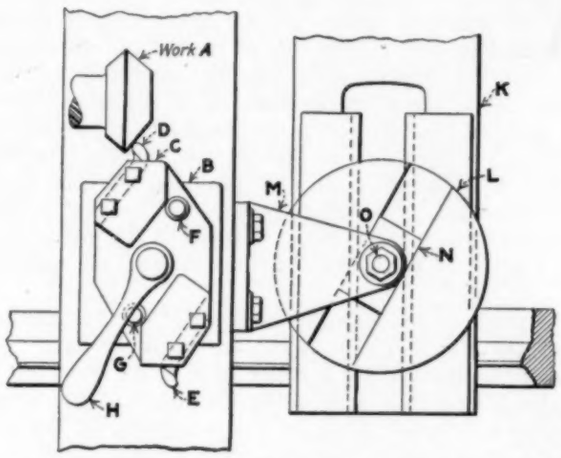


FIG. 364. TAPER TURNING WITH THE CROSS-SLIDE

it from being distorted by the pressure of the roll *K*, which is fastened to the slide.

In order to produce the taper it is only necessary to engage the longitudinal carriage feed, after which the roll travels along the taper bar and thus generates the taper. If for any reason it is inconvenient to attach the taper bar to the headstock of the machine, it may be applied as shown at *L*. The bar *M* is here attached to a rod *N* carried by the bracket *O*, which is fastened to the ways of the machine. The taper bar in this case is supported by a block *P* arranged in the same manner as that previously mentioned.

Taper work can be done by using the compound rest swung to the proper angle on an engine lathe, but when this is done it is necessary to feed the tool by hand. A turret lathe has no compound rest, and yet it is often desirable to use the cross-slide for turning a taper. The attachment shown in Fig. 364 can be used on either an engine lathe or turret lathe; the details of its application are slightly different in each case, but the principle remains the same. The work shown at *A* is to be beveled to an angle of 30 deg. and other work is to be done on it in the same operation. It is therefore desir-

able to do the work with the cross-slide and thus leave the turret free for other tooling.

A special block *B* is mounted on the cross-slide of the machine, and to it is fitted an indexing toolholder *C* somewhat similar in general construction to that described in a previous article. The tool *D* is used for roughing the angle, while that at *E* does the finishing. These tools are of the ordinary forged variety, so that they can be easily reground or replaced when worn. This turret toolpost indexes into only two positions, and these locations are controlled by a plunger in the bushings shown at *F* and *G*. A binder handle *H* locks the toolpost in either position.

The bracket *K* is fastened across the ways of the machine, and on this bracket is mounted a swivel plate *L* which is so arranged that it can be adjusted in a transverse direction. The angle can be changed by simply turning the disk around to the required position. Graduations for various angles can be conveniently placed on the base of the swivel, in order to make the setting easier. The cross-slide is provided with a bracket *M*, at the end of which is a block *N* pivoted on a stud at *O*. This block travels back and forth in the slot in the plate, thus controlling the angle of the taper. It is evident that the cross-slide must be left free longitudinally, so that it can adjust itself to allow the tool to follow the angle of the taper. After the cross-slide feed is engaged, the action of the device is automatic.

If a number of pieces of work are to be machined to various tapers and if the pieces are similar in their general shape, it is quite possible to design a taper-turning attachment with removable taper bars so that all of the work can be handled with the same attachment. When a designer is called upon to develop something along these lines, it is necessary first to determine the largest and smallest diameters which are to be machined. With this as a starting point, the range or capacity of the tool is predetermined; and it is only necessary to make sure that the methods of holding are uniform, in order that the method of machining will be similar in each case.

An excellent example of a progressive design of taper-turning attachment suitable for turret lathes is shown in Fig. 365. This attachment was designed particularly for handling a number of sizes of beveled pinions similar to the one shown at *A*. These pinions were of different diameters and tapers, and it was necessary to make the attachment in such a way that the angular surfaces would be generated accurately and without the necessity for making adjustments to take care of the different angles. The only way in which this could be done with certainty was to use separate taper bars for each angle, thus avoiding any chance of error which might otherwise be caused by a faulty setting.

The tools were designed for both roughing and finishing operations, two attachments being used on opposite sides of the turret. Only one of these attachments is shown in the illustration. The work *A* is held on a special expanding arbor *B* in the nosepiece *C* screwed to the end of the spindle. The body of the tool D is fastened to the turret face. Another tool body of exactly the same shape is on the opposite face of the turret; and a tie member *E* extends entirely across the turret and holds the tool bodies together, thus making a very rigid construction.

The slide *F* is held in place on the body by two flat straps *G* and *H*, and a taper gib *K* is provided on the side opposite to that taking the thrust of the cut, as shown at *K*. A separate toolblock *L* is fastened to the slide by means of suitable screws. This toolblock carries a turning tool *M* which generates the taper. The forward end of the tool body is fitted with a pilot *N* which enters a bushing in the bracket *O* on the headstock of the machine. This construction tends to stabilize the whole attachment when in operation. It also assists in obtaining accurate work, as it preserves the alignment so that there is no chance for variation.

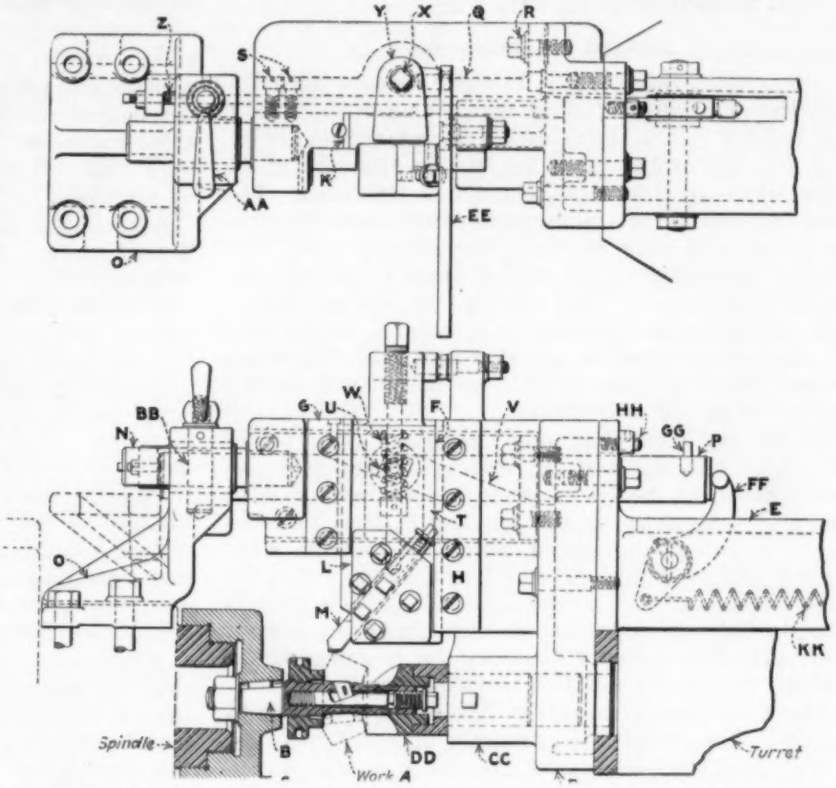


FIG. 365. SPECIAL TAPER-TURNING ATTACHMENT FOR TURRET LATHE

Removable Taper Bar

The taper bar *P* lies in a slot machined at the back of the body of the tool. For convenience in machining the body is entirely open, but ribs on the top and bottom extend out and give greater rigidity. A reinforcing member *Q* is fitted between the ribs mentioned and bolted to the body of the tool at *R* and *S*, thus tying the units together and making them still stronger. There is a cored opening *T* at the rear of the slide; and the swivel block *U* projects through this opening, thus entering and being guided by the angular slot *V* in the taper bar. This construction is shown by the dotted lines. A heavy coil spring *W* is used to keep the block in contact with the slot in the taper bar. Adjustment for pressure is obtained by moving the

special screw *X* up or down as may be required. This screw is threaded into the overhanging lug *Y* on the slide.

The bracket *O* is slotted at one side to hold the taper bar. An end stop *Z* makes it possible to obtain fine adjustments for the bar, so that the angular portion will be in the right relation to the slide. The binder handle *AA* is threaded to the top of a cylindrical plug *BB* through a slot in which the taper bar passes. The various members of this attachment are cored out wherever possible in order to reduce the weight, but there is no sacrifice in rigidity.

Method of Operation

In operation the turret is brought forward until the pilot on the attachment enters the bushing in the spindle cap bracket *O*. It is carried forward sufficiently so that the end of the taper bar strikes the stop at *Z*, after which the binder handle *AA* is tightened. The feed is then thrown into engagement, and the tool moves forward while the taper bar remains still. The slide is controlled by the swivel block *U* which rides in the taper slot *V*, thus causing the tool *M* to generate the taper on the work. The hub *CC* on the body of the tool contains an angular face mill *DD* which is used to remove the stock from the cupped surface at the end of the gear blank.

After the taper has been generated, the binder handle is loosened and the entire mechanism drawn back away from the work. When this has been done the operator pulls down on the handle *EE*, thus relieving the pressure on the spring which controls the slide. This allows the kicker *FF* to act against the end of the taper bar, moving it forward until it is restrained by the pin *GG* coming in contact with the spring bumper *HH*. The coil spring *KK* exerts the pressure on the kicker. The turret can now be indexed and other tools brought into use on the work. The final cut is made by another taper turning tool exactly like this one.

The possibilities of this tool cover a wide range. The device was so designed that the toolblock *L* could be removed and a boring toolholder substituted for it, so that tapers could not only be turned but could also be bored to any size within the range of the attachment. Taper bars of various angles can be easily substituted to handle different pieces of work. The accuracy obtained on taper work with a device of this sort is fully equal to that which can be obtained on an engine lathe with a taper attachment. Attention is called, however, to the provisions made for adjustment and for handling various diameters of work. Naturally, as tools of this sort are somewhat expensive, it would not be economical to make anything of the kind unless the production were great enough to warrant the expenditure.

Nickel Plating Gas Engine Pistons

By Chester Lynndelle

The article by David Tyke, on page 287 of American Machinist, entitled "Nickel Plating Engine Pistons," is the first word the writer has ever seen in print on this subject.

Some five years ago a somewhat similar experiment was tried by the writer on the pistons of a twin-cylinder car of ancient vintage. Being of the horizontal-opposed type, it seemed that the pistons and rings wore more rapidly than those in a vertical-cylinder engine, as pistons were replaced at intervals of five to six thousand miles. Finally the cylinders wore so large that stock replacement pistons were unobtainable, when through the suggestion of a plater friend a coat of nickel was applied much as Mr. Tyke describes—except that there were some half dozen trials made before the nickel could be persuaded to "stick" properly.

After buffing the pistons to smooth out the irregularities of plating, the engine was reassembled and the nickel-plated pistons given a try-out. For about a month they gave fine service, and then, when the crankcase oil had become slightly diluted with kerosene, they cut out in just a few miles' running, knocking vigorously and setting up a series of groans that could be heard for blocks.

The Effect of Kerosene

Upon examination it proved that the kerosene had loosened up the glaze in the cylinder wall, and that the pistons had literally had strips of the nickel peeled off; fine, tightly coiled shavings, as though turned off with a diamond point, were found in the crankcase and in the combustion chamber.

After much tinkering and theorizing it was decided that the expansion of the copper facing used to bind the nickel to the iron was so much greater than the iron beneath that it had "crawled" sufficiently to start the trouble, and that the diluted lubricant had merely aided in the stripping process.

A further trial was made with a Schoop metal spraying gun, after the piston had been thoroughly cleaned of the old copper and nickel coat and roughened in a lathe. With the gun a coating of nickel was built up as a basis, after which electroplating was carried on as before.

The pistons enlarged by this method were still in service when the car was finally scrapped after some ten thousand miles of service as a delivery truck. To restore the cylinder wall gloss, graphite was fed in at intervals through a "gas-saver" opening in the intake manifold, and this in all probability was largely responsible for the excellent service secured.

Shall We Standardize Tapers?

THIS is a continuation of a general discussion on the merits of various tapers with a view to crystallizing sentiment in favor of one particular type. The first part of the article, published April 13, gave the opinion of some thirteen manufacturers. Other opinions on the subject are as follows:

No. 14. Years ago—how many, I am afraid to say—a contributor to AMERICAN MACHINIST wrote under the name of "Jarno," and among the good things offered by him was the Jarno taper. It always seemed to me to be the most consistent system in the way of tapers for a standard that has ever been proposed. I cannot help but think that if the mechanical world at that time had recognized the value of standardization as it does today, the Jarno taper would now be the standard, and in universal use. If a good mechanic, foreign born and educated to the best standardization ideals, were to suddenly find himself transplanted to the United States, he would certainly be amazed at our adherence to odd ideas concerning so-called standards that never were right. He would wonder at our sentiment, selfishness, and general shortsightedness in not moving straight ahead toward an economy always followed by proper standardization.

In my experience, I have found that anything for which any of the commonly used tapers is satisfactory would be equally satisfactory if the Jarno taper had been substituted. Standardizing tapers would, however, be a much more difficult problem today than at the time the Jarno taper was proposed, although the same or more proportionate advantages would be obtained. The cost to manufacturers would be many times greater at the present time if we consider the increase in tapers in use.

If the Jarno taper were considered at the present time as the standard, there would be more opposition from the general public because it is little known, and this would require replacing the two well-known tapers, Brown & Sharpe and Morse.

Twenty-five years ago, there were many more tapers in use than at present, and the need for standardization was more apparent. Today the Brown & Sharpe and Morse tapers greatly predominate, so that the choice of a standard in the part of the mechanical world with which I come in contact would be from among the three mentioned.

The records of our factory show that we have 721 machines with the Morse taper, 327 machines with the Brown & Sharpe, and 23 with the Jarno. A great many of these are ordered with Morse tapers regardless of the makers standard. We have a great many so-called adapters which transform one system to the other, and we can thoroughly appreciate the economy and convenience of one standard. We could standardize on the Morse taper at a less cost than any of the others, and it would suit our particular business better, if, of course, the drill shanks remained as they are. If, however, the shanks of drills conformed to a new standard, this feature could be neglected.

The cost of standardizing on Brown & Sharpe would be greater than for the Morse, merely because of the number of machines. If the Jarno were to be standardized, the cost would probably be more than for the other two on account of the greater number to change. This change, in some of our machines, would not be very serious, because the Jarno taper is so near the Morse, and in many cases the diameter at the point is not so essential for the interchange of fixtures as the diameter of the hole at the nose of the spindles and the taper.

If the majority of the manufacturing public of the United States should vote to adopt the Jarno taper as standard as fast as possible and use their influence wherever possible to get it into use, I believe that the cost of the change would be offset in a few years, and we would wonder why we ever questioned the advisability of it.

TWO FAVOR MORSE, ONE JARNO

No. 15. We are advocates of the Morse taper, basing our opinion entirely on the production machines in our plant. We believe that this is the most common taper in use and see no reason why it should not be adopted as the standard.

No. 16. As the Morse taper is more generally used and almost exclusively adopted for all sizes and styles of drill presses, lathes, and turret lathes, we advocate this taper.

No. 17. We have adopted the Morse taper and are equipping all of our machines with it unless otherwise specified. We have been requested to furnish machines with Brown & Sharpe and Jarno tapers, but it is certainly more or less confusing to make these changes, and we would heartily endorse the adoption of a single standard, preferably the Jarno.

No. 18. There seems to be no question but that a single standard would be of great advantage. The writer's preference would be the Brown & Sharpe taper; this on account of its uniformity and also having been standard in so many tools. We might add that we are using the Brown & Sharpe taper in our automatic gear cutting machine and Morse taper in our lathes, conforming to the usual practice.

No. 19. We believe that there should be a fixed standard for tapers. In order to obtain as near this result as possible, we are limiting our purchases of machine tools to those using standard Brown & Sharpe tapers, which we believe to be sufficiently satisfactory for all mechanical purposes. On account of our greater experience with Brown & Sharpe tapers, we are not in position to state the advantages of the Jarno standard. We do, of course, use Morse tapers for all of our drilling machine work, but do not believe they are as well adapted to other machine tool spindles as the Brown & Sharpe.

ECONOMY FOLLOWS STANDARDIZATION

No. 20. If there is any advantage in the different tapers it is very slight. To pick out the taper which should be adopted as a standard would be an easy matter. There are a great many machine tool builders who still believe that they could control the market in their particular type of tool, simply because they are using a certain taper in the spindles, and it surely would be to great advantage, not only to the consumer but to the manufacturer, to have a standard taper adopted for all spindles. This is followed out to some extent in milling machines, lathes and drill presses. We believe economy always follows standardization.

No. 21. Our own practice is somewhat varied as we use Brown & Sharpe tapers up to No. 14 in our small and moderate size machines, and in the larger sizes we use tapers that are standard in our own shop only and which were the original tapers before our adoption of the Brown & Sharpe. In our particular line of manufacture we do not see that there would be any great advantage in changing now to one standard, as the arbors made for our machines are seldom if ever used on any other makes of machines. We are thoroughly in sympathy with the standardizing program, however, and are finding it to our advantage in other features of our design to study this point much more closely than ever before.

No. 22. Modern milling machines are equipped with Brown & Sharpe tapers; drill presses, radial drills and boring mills with Morse tapers. Brown & Sharpe tapers are more consistent in their design than the Morse, being 0.500 in. to the foot, disregarding the number of the taper, whereas the Morse varies from 0.602 to 0.625 in. without apparent reason.

The Brown & Sharpe taper having a smaller included angle is better suited for milling machines, gear cutters or any other type of machine, where a great side thrust is exerted. This side thrust has the tendency to cause the tapered end of the cutter arbor to work loose. The Brown & Sharpe taper has a greater frictional driving power than the Morse. In modern milling practice for heavy duty, this condition is not taken advantage of as the driving is done through a flange located at the front end of the taper. The

practice of driving through a tongue at the small end of the taper should be discontinued except in the case of small end mills and small arbors for light duty.

All our gear-cutting machines for the trade are equipped with Brown & Sharpe tapers. In our milling machine department we have adopted No. 11 and No. 14 Brown & Sharpe tapers as our standard; in both cases the driving is done by a flange located at the base of the taper fitting directly into the spindle of the machine. Everybody has trouble with tangs of drills breaking, due, we believe, to having Morse taper shanks. It is our belief that drills with Brown & Sharpe tapers would eliminate that condition to a great extent.

Uses Many Tapers

No. 23. With regard to the merits of the Brown & Sharpe, Morse or Jarno taper, the writer has the impression that it would be a blessing to the country if any one of them had been adopted ten or twenty years ago and the others forgotten. In the design of our machines we use a number of different tapers. For instance, we are using a taper of 1¼ in. per foot (more than twice that of the Morse) for the spindle bearings in our wheelheads, as this allows us to take up wear in a most satisfactory manner without making too much end-wise adjustment.

On the other hand, in the case of some of the smaller wheelheads where we wish to mount quills of small sizes, we have used one of the small Brown & Sharpe tapers because they have quite a wide variety of sizes as compared with the Morse, or, as I remember it, with the Jarno. There we are limited with regard to the size of the hole which we will drill in the end of the spindle and the designer has more of a choice of tapers by using the Brown & Sharpe where the large diameter is in the neighborhood of ⅞ or 1 inches.

No. 24. It is our impression that the Morse taper is in more general use than any other and we believe its adoption as a standard by all machine tool builders would be a good move.

No. 25. We are very much set on the Morse taper as far as our shop equipment and the machine tools we are building are concerned. In fact we specify nothing else but Morse tapers. We believe that the Morse taper is in more general use than any of the others. There is no question as to the economy as well as the convenience of having a single standard among machine tool builders, but it would mean a very great expense to use to use anything else but the Morse taper. In fact we would like to change over to anything else from the Morse taper about as well as we would like to change from our present system of measurement to the metric system.

No. 26. Ever since we have been in business we have used tapers which were current at the time we started out. We have never, except in one instance, adopted any of the standard tapers as a regular thing. In one line of machines which we started to build, we adopted the Brown & Sharpe taper, as probably representing more nearly the standard practice of machines of the general type that we were building. We did not change the taper in our older established lines. The experience that we had with the Brown & Sharpe taper in that one line of machines did not give use sufficient data to work from to determine whether or not it would be advisable to attempt to adopt such tapers for all machines. We expected, in adopting this taper, to be able to buy standard shanks and collets that we could use on our machines, but we found that the proportion of the standard items we would buy was so small as to be almost negligible. In nearly every instance, owing to the special nature of the tools to be used, they had to be made, so that really the taper had very little to do with cutting down the possible expense.

Likes the Jarno

No. 27. If it were a question of starting all over again and disregarding all existing tools, etc., we should prefer the Jarno taper as it seems to be ideal on account of its simple formula and uniform taper. However, this condition does not exist, and the next best standard is the Morse taper. For drill presses and lathe centers it seems there can be no objection to the Morse taper, but for milling machines, we would prefer the Brown & Sharpe half-inch taper per foot. As most shops have Morse taper reamers and gages, it would be less expensive and more satisfactory to adopt the Morse taper as standard.

No. 28. Although our product does not require taper sockets of any kind, still we would be only too glad to see some taper adopted as a standard for lathes, drills, millers, etc. We have about four different tapers in our plant and they cause very much confusion and an added expense in carrying so many drills etc., to fit them. All three tapers you mention have their merits and defects. The Brown & Sharpe is very good but being so much longer than any of the others, it requires that much more material for all bars, cutters, drills etc. This item alone would condemn it in many cases.

The Morse taper we find is too abrupt as the sockets have a tendency to fall apart; and then every Morse taper has a different degree of taper, making it hard to remember when turning bars, drills, etc.

The Jarno, while it has the faults of the Morse to some extent, has the advantage of being dimensioned in a very simple manner and the number of the taper can always be told by measuring the ends or length. While we do not think Jarno is the best, we think it is a step forward and if a happy medium between a Jarno and Brown & Sharpe could be found, we think it would fill the bill.

No. 29. We agree that a lack of uniformity on tapers leads to confusion and the multiplication of tools and arbors. We also agree that because of this there is an unnecessary waste which could be avoided by having a single standard.

Our experience shows that the Brown & Sharpe taper is satisfactory for milling machines. We believe manufacturers have in the past been using too small sizes or numbers of tapers in the different sizes of machines and which did not allow enough area in the surface contact.

We feel that the Brown & Sharpe taper holds somewhat better than the Morse on account of its small taper per foot. This same argument would hold good against the Jarno, which is almost the same taper per foot as the Morse.

Wonders at Morse Variations

No. 30. Not being familiar with the history of the development of the Morse taper my deductions may be wrong but it seems to me that the original tapers, because of the lack of proper facilities, were turned and the error in them standardized. I cannot conceive why the tapers should have varied from 0.600 to 0.630 in. Surely this cannot have been the result of an attempt to make the tapers vary with the idea that it would be better suited to the diameters involved.

The Brown & Sharpe taper would, in general, be satisfactory were it not for the fact that the No. 10 taper varies from all the rest, and I cannot understand why this is so. The nearest approach to a sensible system is reached in the Jarno tapers.

A uniform taper per foot should be established for drill shanks, lathe centers, milling machine arbors, etc., and the sooner this is done, the better. I dare say that drills with taper shanks would not have their tangs twisted off so frequently if a taper of ½ in. per foot were standardized. This subject really deserves very careful thought, but whether a taper of 0.50 or 0.60 in. per foot is finally adopted, it should be made uniform throughout for all sizes. I have always looked upon the Morse taper as a perpetuation of an error.

No. 31. We use the Brown & Sharpe taper because it is a straighter taper and hence better adapted to the use of end mills. It has been our experience that in using a Morse taper with end mills that the strain on the side of the cutter tends to loosen it in the spindle and the straighter taper of the Brown & Sharpe overcomes this difficulty.

No. 32. We believe that the taper to adopt would be the Jarno, owing to its being based on a formula easily retained in one's mind. We believe the adoption of a single standard an excellent idea, and even if plants would adopt

the slow process of having their new tools and replacements carry the taper adopted as standard, it would only be a matter of a few years until the standard taper would become generally adopted.

No. 33. From our standpoint, the Morse taper seems to be best, although we admit that its start was on a wrong basis, with reference to uniformity. However, it has been so widely adopted throughout the world for certain classes of machinery we do not see how it can be changed. The same thing may possibly be true of the Brown & Sharpe taper, but not to such a degree. The Jarno is based on a uniform basis, but is only a little known and not much used. We do not believe that you can ever reconcile users and manufacturers at this stage of the game to a uniform taper. You will meet such tremendous opposition from well-known sources, and from unexpected sources, that it will be impossible to bring this about. Something like trying to change from English to metric system, only not so bad.

Three More Jarno Advocates

No. 34. We are inclined to favor the Jarno taper because it is constant instead of changing. In this we feel it is superior to the Morse, and it has a somewhat greater included angle than the Brown & Sharpe. We think this better since it has been our experience that the Brown & Sharpe taper seats in too binding a manner at times.

No. 35. Our opinion is that the Jarno taper would be the best to adopt as a standard, the reason being that the Jarno formula is simple and uniform. We firmly believe that one standard taper would be a great convenience, as well as an economy.

No. 36. It seems as though when we are designing fixtures for our various lathes, we find that no two of them have the same taper in the spindle nose, a feature which limits the use of tools and increases the number of tools necessary. In our own manufacture of machines and tools we use only the Morse taper, and have found but one instance in which this taper could not be adhered to. That was a case where we wanted a size that came between the No. 4 and No. 5 Morse.

Personally, I believe that the Jarno taper would be the best to adopt for universal use, but it would mean a great expense to everyone like ourselves who have already standardized on the Morse or other tapers. However, we realize that it costs real money to make improvements and we would be glad to do our part along this line in co-operation with other manufacturers, if a suitable taper is decided on to cover all conditions.

No. 37. Our work is coming more and more to be in the drilling and boring lines only, so that we rarely furnish anything but Morse tapers. It seems to us that a standard taper for drilling, boring and milling machines, lathes, etc., would be desirable, but whether the cost of changing over would more than overcome the advantages, I am not prepared to say. We would be willing to abide by the decision of the majority and adapt ourselves to whatever seemed to be the most advantageous.

No. 38. We now use standard Morse tapers in the spindles of all our lathes and prefer to hold to this taper. As we understand it, most of the machine tool builders, or rather a large majority, use the Morse standard taper.

No. 39. As the situation stands now it is quite a nuisance to worry about three different standards, and personally I think it unnecessary, as all three standards are good and any one of them could be adopted. For simplicity sake, we are in favor of Jarno tapers, as it is simple to remember and the taper per foot is the same on all sizes.

The writer has also been advocating the standardizing of such parts of machine tools that hold the work and the tools. For instance, in the lathe a standard taper in head and tailstock spindle and standard size toolpost. On a radial drill, a standard diameter of spindle nose, as well as taper, standard T-slots for the table, etc. Of course, there would be a standard for each different size. We are very much in favor of standardizing and would adopt anything within reason along these lines.

(To be continued in next week's issue.)

Core Plugs and How to Make Them

By A. J. Langhammer

"Core plug" is the name by which the peculiar type of expansion plug described in this article is known to mechanics and engineers. The title has become a

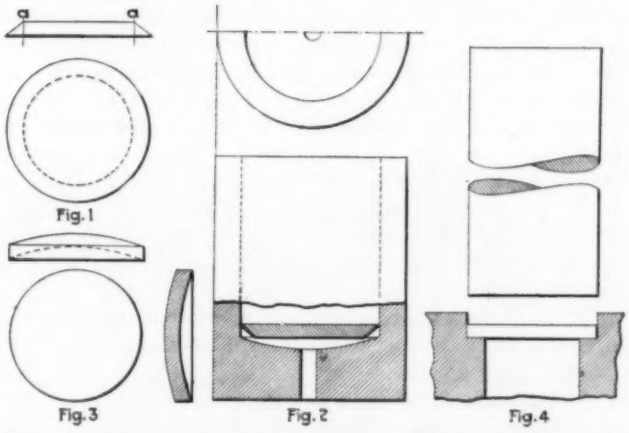


FIG. 1. THE CORE PLUG. FIG. 2. FORMING DIE WITH CORE PLUG IN POSITION FOR FORMING. FIG. 3. CORE PLUG AFTER FORMING. FIG. 4. PASSAGE SEALED BY A CORE PLUG

fixture with this plug, because of its almost universal adoption for plugging core holes in the water jackets of automobile cylinders.

A core plug for a 1-in. hole is shown in Fig. 1, which pictures at a glance the small amount of metal used. The labor cost of manufacturing is very low as is the cost of application. The writer has used core plugs on cast iron, carbon and alloy steels and for these materials cold-rolled steel in bar stock or low carbon steel in sheet stock has proved the most satisfactory. For a limited quantity it is best to make the plugs on an engine lathe to the shape shown in Fig. 1 and care should be exercised to make the base or largest diameter with a sharp edge so that it will "bite" in. Fig. 2 shows a die with a core-plug in position for forming. In Fig. 3 is shown a finished core plug, which with the sectional view in elevation is very clear.

In Fig. 4 is shown a plugged oil passage in a section of a crankcase with a core plug driven home. Immediately above is shown the "set" which is merely a short piece of cold-rolled stock with squared ends, and which with a machinist's hammer comprises the only tools necessary for assembling. At the first glance the strength of such a joint is not apparent. It is therefore necessary to again refer to Fig. 1. Here it will be observed that the metal shown in the small triangles *a*, *a* which, in the plain view, is the area between the dotted and the full circle, really forms a caulking medium. This is obviously a huge amount of metal and when driven in place, as shown in Fig. 4, forms a very strong and durable joint.

The writer has used core plugs on machine tools, fixtures and automobile parts and in diameters up to 2¾ inches.

Machine Operations in a California Pump Shop

Adaptable Shaping Fixture for Pump Brackets—Operations on the Vertical Turret Lathe—An Interesting Milling Operation—Turret Lathe Work

SPECIAL CORRESPONDENCE

THE illustrations shown herewith represent methods of manufacturing centrifugal pump parts in a factory in the Sacramento Valley.

The halftone, Fig. 1, shows a shaping operation on the base of a pump bracket. The work is here shown mounted in a special fixture in a Gould & Eberhardt 28-in. shaper. This fixture is adapted for holding all sizes of brackets, and to make the change from one size of bracket to another it is merely necessary to change the adapter plugs at the ends upon which the bracket is hung up for the shaping operation. This is brought out clearly by the detail photograph, Fig. 2, which shows the fixture and the bracket on the shop floor with several adapter plugs and collars in the foreground.

The bracket casting is bored out on a horizontal

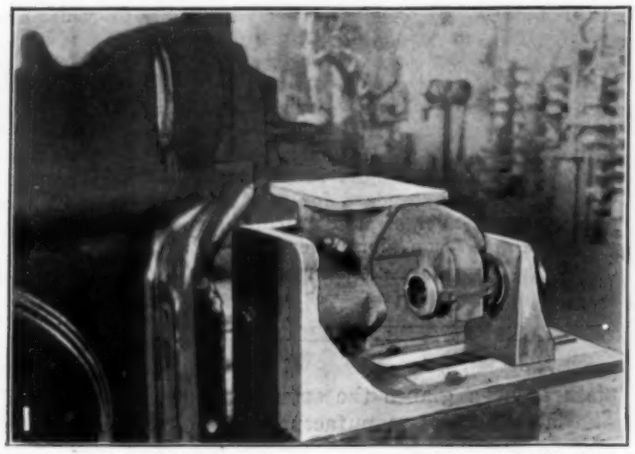


FIG. 1. PUMP BRACKET IN THE SHAPER.

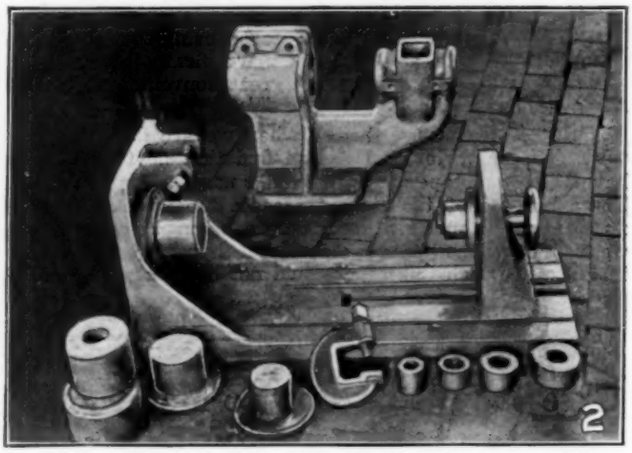


FIG. 2. SHAPER FIXTURE FOR PUMP BRACKETS

machine, and when it comes to the shaping operation, the proper head plug is inserted in the upper end of the fixture where it is secured by three hexagon head capscrews tapped into the flange around the base of the plug. The adapter rings for the handwheel screw at the right-hand side of the fixture are slipped over a sleeve which is tapped out to receive the screw for the handwheel. A washer and screw hold the adapter collars in place. For general adjustment to length to suit different widths of brackets, the outboard support for the work is adjustable longitudinally on the base and secured at any point desired by a square-head bolt sliding in the T-slot in the casting.

The two lugs at the top of the left-hand upright on the fixture carry setscrews which bear against the walls of the bracket to bring it into level position crosswise for the planing operation.

The drilling of the bolt holes in the base of this type of bracket is accomplished, as shown in Fig. 3, with the aid of a jig which is also arranged for taking care of various sizes of brackets. Details of this jig are clearly brought out in Fig. 4. The jig consists of an angle casting, in the upright of which is fixed a horizontal post, over which are fitted adapter sleeves to suit all sizes of brackets. In the rear wall of the upright leg of the jig casting there is a guide slot to receive the guide at the end of the different jig plates. A clamp screw and stud provided at this point secure in place whichever jig plate is used on the job. Referring again to Fig. 3, the bracket to be drilled is slipped over the locating sleeve in the jig and tightened upon this holding sleeve by means of a C-clamp, which is gripped upon the bosses at either side of the slot cut through the main bearing. This binds the work upon the sleeve, and the outer end of the casting is supported at the same time by a short jackscrew placed as represented in Fig. 3. The work is handled under a radial drill as shown in Figs. 3 and 4.

The casings or bowls for centrifugal pumps are bored through the wall and faced at the side for the joint surface in the manner illustrated in Fig. 5, where the job is shown on a Bullard vertical turret lathe, with the casting resting on and gripped in the four jaws on the table. With the work in this position the various turret tools are brought into action one after another to bore out the casing, rough and finish the large opening in the top of the casing, and to rough and finish the joint face on the outer surface. With the surface referred to finished as indicated, the bowl casting is ready to be machined across the face of the flange. This latter operation is attended to on a big milling machine, with the work placed over a locating ring which is mounted upon the table of the miller. This locating ring is another form of adapter which fits over a central plate secured to the milling machine table. The plate carries a vertical stud with suitable clamps and quick acting nuts to hold the work down in place. For the different sizes of pump casings, the adapter rings referred to above are changed by merely slipping them off from the central plate and replacing them by the ones required, so that the simple arrangement of very few parts takes care of all sizes of casings.

The actual milling of the flange face is accomplished with a large inserted tooth milling cutter, carried on the nose of the spindle.

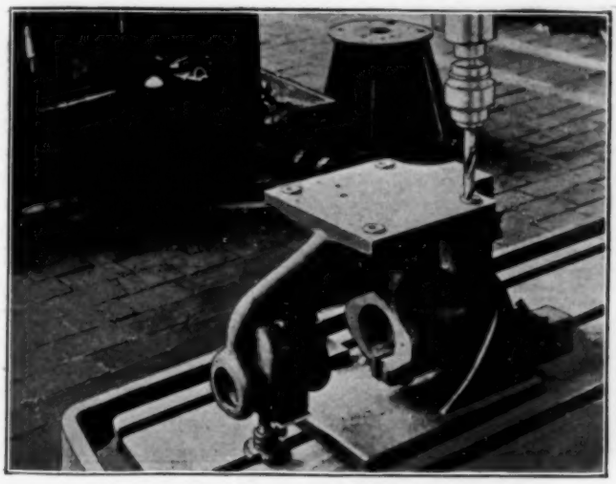


FIG. 3. DRILL JIG FOR PUMP BRACKETS.

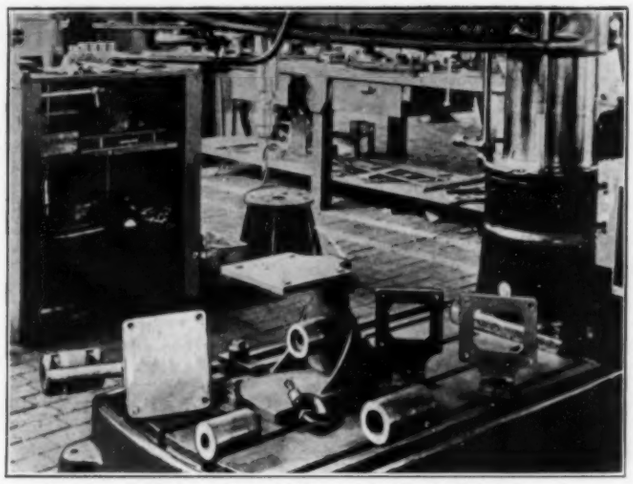


FIG. 4. SET OF AUXILIARY JIG PLATES FOR BRACKETS

On this make of pump there is used a combined elbow check valve which has a cast body with three faces at different angles to one another, as shown in Fig. 6, where two of these castings are seen in place in a special fixture on the table of a horizontal boring machine. The method of facing the round flanges at the ends of the elbow proper is to mount the work upon the angular fixture, as illustrated, and accomplish the surfacing by means of a milling cutter on the horizontal spindle. The fixture itself has two sloping faces at the proper angle to suit the elbow to be machined. While one casting is undergoing facing operations, another casting can be clamped in place on the opposite face of the fixture. Thus little time is lost in the process of removing finished work and replacing it with rough castings, as the handling of the job into place is going on at the time the cut is being taken on the opposite piece of work. The method of securing the baseplate of the fixture to the boring mill table and the means for clamping the upper or movable part of the fixture are easily seen in the illustration. The milling cutter on this machine has a 10-in. body in which are inserted blades of high-speed steel, these blades measuring 2 in. long, 1 in. wide, and ⅜ in. thick. The cutter is one of many sizes made at the plant and used for a variety of purposes in the production of pump members.

The combined elbow check valve is seen undergoing another operation in Fig. 7. Here it is shown set up on the shaper for the surfacing of the end flange. The fixture upon which the work is mounted for this operation is a peculiar form of angle iron, the wings of which are finished at the necessary angle with the base to locate the check valve elbow with the top surface in the horizontal plane. Thus without adjustment of the work upon the fixture or of the fixture upon the shaper knee, the top of the casting is in proper position for finishing, as soon as a couple of C-clamps have been applied to grip it securely in place.

Turret Lathe Work

A good deal of the work at this plant is accomplished in the turret lathe and a view of a Steinle machine in operation on spiral covers is shown in Fig. 8. These covers for different sizes of pumps are handled by boring out the hub and finishing to size and then slipping over a locating plug which is carried in the spindle of the lathe. Through this plug extends a draw-in bolt which has a nut at the outer end and an open washer as shown in the illustration, so that the removal of the work is accomplished very quickly and new work is rapidly put into place. The tools and the turrets are shown distinctly and their general character will be appreciated without detailed description.

Many classes of jobs are handled on this type of machine, including among other items the impellers or runners for the pumps which are chucked and machined in practically the same way as the spiral covers illustrated. In connection with the runners just referred

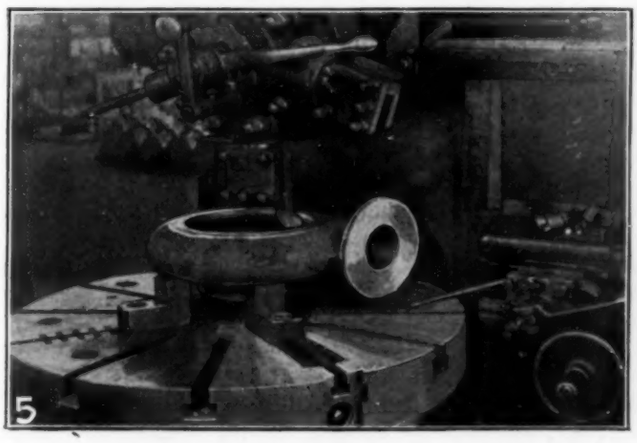


FIG. 5. BORING OUT A PUMP CASING.

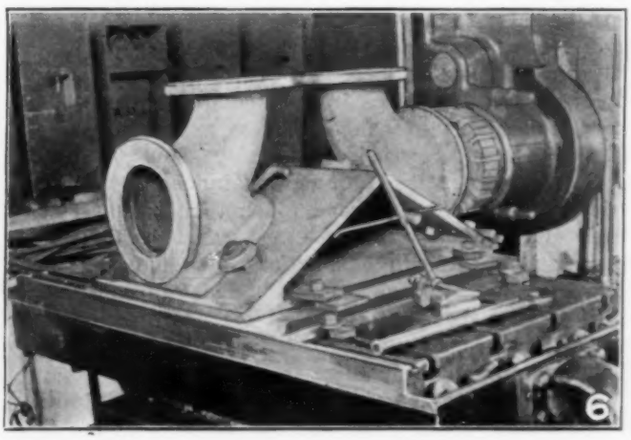


FIG. 6. MILLING COMBINED ELBOW CHECK VALVES

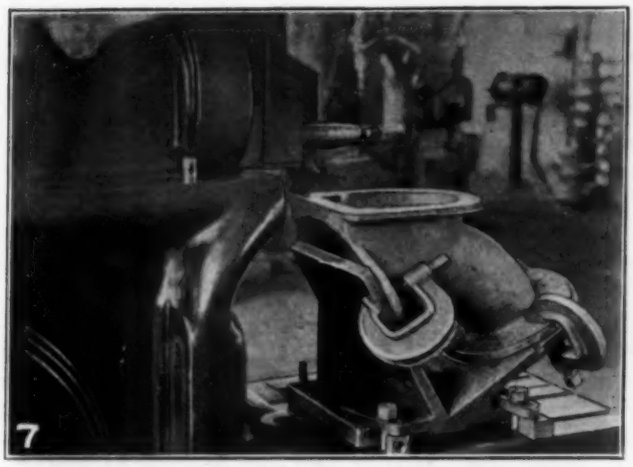


FIG. 7. SHAPING COMBINED ELBOW CHECK VALVES.

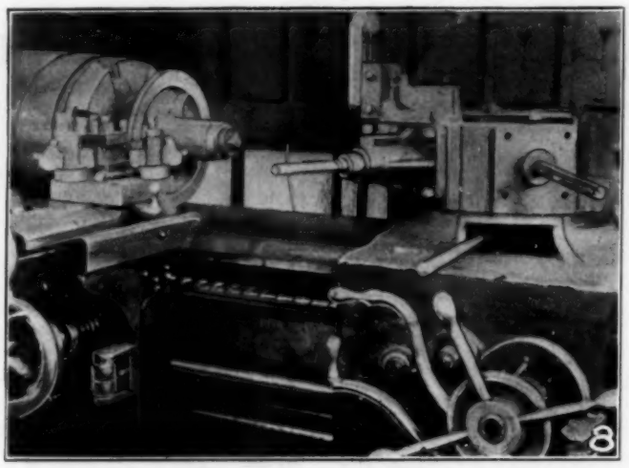


FIG. 8. PUMP COVER OPERATIONS IN THE TURRET LATHE

to, one interesting process which is carried out under a radial drill is the facing of the inner end of the hub. The other surfaces are machined after the job is set up in the turret lathe, and for the squaring off and finishing of the inner end of the hub, the casting as it comes from the lathe, is placed over a fixture under the radial drill, this fixture consisting of a circular plate with an upright post over which the work slips freely. A cutter bar is brought down with the spindle of the drill, and a flat cutter carried by the bar faces off the end of the hub to the desired dimension.

The illustrations presented in the foregoing article are selected from the many interesting features of practice at the shops of the Superior Manufacturing Co., Lodi, California.

Railroads Need Business Methods

BY C. J. MORRISON

The article by Herbert Hoover, Secretary of Commerce, on page 262 of AMERICAN MACHINIST, is very important and instructive. But one point should not be lost sight of, overlooked, hidden, or forgotten—and this is that the railroads are inefficiently operated in practically every department. This is not because the officials are incompetent or indifferent; nor is it because they are not working hard and conscientiously, but it is because they are terribly handicapped. There is probably no body of men in the world more able or hard working than our railroad officials, but they are handicapped, not only by numerous laws and regulations, but also far more seriously by the fact that railroading has been conducted as a business within itself.

In other industries there is a continuous exchange of employees and executives from one industry to another with a consequent exchange of ideas and methods, but the railroads seldom receive an employee and practically never get an executive from another industry, while the exchanges from one railroad to another are not very great. Even though there was a considerable interchange among the railroads, little good would be accomplished as the methods are similar on all railroads. The result is that the employees and officials are in a rut and are so steeped in tradition and prejudice that it is almost impossible to affect improvements.

To illustrate the point, consider an example familiar to every one. Many years ago in the days of the link and pin couplers, single track operation, no air brakes and no block signals, it was necessary to place on the rear ends of trains flags by day and lanterns at night. Today hundreds of thousands of dollars are spent by the railroads every year to maintain these things which, in all but a very few instances, are utterly useless. Incidentally, the railroads would not adopt the automatic couplers and air brakes until they were forced by law to do so, and they tried in every possible way to prevent the passage of these laws.

Henry Ford showed what can be done with a railroad by someone who, with no railroad experience, managed a railroad like any other business. Not only has he made his little road pay, but he has increased wages.

A railroad is a hard business to supervise and is so full of trials and tribulations that officials are too everlastingly busy with their daily problems to think much about economies. Each railroad needs an executive who could devote his entire time to the various problems to affect economies, and he should be a man with a broad experience outside of railroad work. There is no need for the Taylor or any other particular system, but rather the application of good common sense and outside business experience is required.

Probably the greatest money waster is the mechanical department, due partly to the fact that it is an expense department and therefore neglected, and partly to the lack of other than railroad experience by the employees and officials. It is so hard to get an appropriation for the mechanical department that the shops are full of antiquated machines and devices. The employees from this department are so notoriously slow that few outside concerns will hire them if others can be obtained. Let some courageous railroad official secure for one of his shops a high-grade superintendent from outside the railroad, give him the equipment he asks for and see what he will do to the repair bill for locomotives and cars.

In this connection it may not be out of place to say that such a superintendent will demand 50 to 75 per cent more salary than is usually paid for the position. Railroad officials are notoriously underpaid and this is another handicap. Railroads train many men only to have them leave just as they are becoming valuable.

The railroads certainly should be run as other business enterprises are, and this criticism is written with the hope that it will not add to the handicap, but that it may arouse some thought on the subject and may accomplish some good.

Selling Engineering Service

By Alex Dowel

The salesmanship required in selling any form of engineering service is of a highly specialized nature and it cannot be classed with the selling of a concrete article. The salesman must be more than a canvasser who introduces a certain kind of goods, and should be considered as a combination of salesman and engineer.

In the salesman for engineering service—consulting, industrial, or production—two important points are required: First, a full knowledge of the service he is selling and second, implicit confidence in the firm for which he is working and its ability to render adequate service to the client. It is vitally necessary that the feeling of confidence be inspired in the salesman as otherwise he cannot influence a client in the right direction and imbue him with the necessary confidence in his firm.

Let us suppose that a consulting mechanical engineering firm specializing in production methods requires the services of a salesman to introduce its engineering service to various manufacturers of mechanical products. The man selected for this job should be one who has some knowledge of general shop practice so that he may be able to talk intelligently about it. At the same time the salesman need not be a strictly first-class engineer who has specialized in the particular line with which he is associated. The ability to sell and to impress the customer is more important by far than a knowledge of engineering. Past experience which enables the man to talk intelligently about the general conditions governing the work is a valuable asset and should generally be considered as an important factor in his selection.

If a reamer, tap, die or other small tool is to be sold the salesman usually has a sample, but in selling engineering service he is selling the service of a professional man and may be classed as a salesman of "brains." It is easy to show a man a suit of clothes and land his order but to sell "brains" to him is not so easy. Yet a competent sales engineer with the right qualifications can do it—can, at any rate, influence the sale and bring the client to the point where he is willing to talk with the consulting engineer regarding his problems.

In the writer's opinion the salesman's principal business is to get in touch with firms requiring the kind of service his company is able to furnish and *to make the client eager* to have a talk with the engineers in charge of the work.

Qualifications

The sales engineer who attempts to sell engineering service must have qualifications that resemble those of an ordinary salesman, yet different because it is necessary in this class of work to be more familiar with important details. The following list notes briefly the various qualifications: (1) Ability to sell service; (2) knowledge of the service that he is selling; (3) personality; (4) knowledge of character; (5) diplomacy; (6) honesty and conscientiousness; (7) understanding to enable him to meet competitors; (8) understanding to enable him to adjust losses and generally to render satisfaction to the customer; (9) ability to market the service at a substantial profit.

I have mentioned the ability to sell service first. A salesman may be a competent engineer and yet may not have a sufficient flow of language to express himself properly and inspire confidence in the client. The ability to talk is therefore a valuable asset in a salesman but he should not by any means acquire a reputation for "gab." The experienced man will gradually lead his client up to the various points with which he wishes to impress him and he will do it in such a diplomatic way that it will not appear on the surface.

A great deal of harm can be done to an engineering firm by a salesman who creates an unfavorable impression, who makes statements as to current practice which are not in accordance with good engineering ideas. The man who understands his business will answer questions up to the point where there is some uncertainty in his own mind and at that time he will state that this phase of the situation is out of his line but he will be glad to refer it to one of the firm's engineers. Technical questions can usually be disposed of in this way to the advantage of all concerned, as they will then be brought up before the right man and accurate statements made which will be of assistance to the client. No salesman should be afraid to say that he *does not know* just how a certain matter would be handled, as he is not supposed to be a consulting engineer but rather a salesman. Neither is he supposed to go about the country and give out valuable information without charge, although it is perfectly legitimate for him to do all he can to assist a client when there is a prospect of making a friend.

Aggressive Diplomacy

The personality of the salesman enables him to obtain an interview with executives so that a statement of service can be presented to the parties most interested and most influential in turning the business in the right direction. Men with the qualifications of intelligence, energy and honesty and having good address will make a success in salesmanship while the quiet and unassuming man will often lose by a lack of assertiveness, so that he will miss a great many interviews which a more energetic salesman would obtain. Dignity should not be sacrificed and the aim should not be to obtain a reputation as "hail fellow, well met" because this attitude is likely to result in the impression that the firm represented cares more for the frivolous things of life than those which are serious. The ability to judge of the character of the executive with whom he is talking and to use diplomacy in his talk with him is a decided advantage to the salesman. A straightforward manner of talking, which is at the same time not too abrupt, gives the impression of honesty and will oftentimes enable a man to obtain a long interview, when any tendency toward concealment would leave a different impression unfavorable to the firm.

Another point of importance is the ability which a salesman should have in giving satisfaction by the adjustment of any losses that may have occurred during the progress of the work. This matter calls for the use of considerable care, yet at the same time it must be combined with business judgment in order to place the fault where it belongs without giving offence. It may be a matter of hundreds or even thousands of dollars, or it may be only a few dollars; but in either case the justice of the claim should receive first consideration. The honesty of the firm will be judged by the attitude of the salesman and there should be no hint at any time of any tricks or shady transactions which would reflect on the integrity of both salesman and firm. The straightforward plain business policy must always be followed and when this is done the results will be convincing.

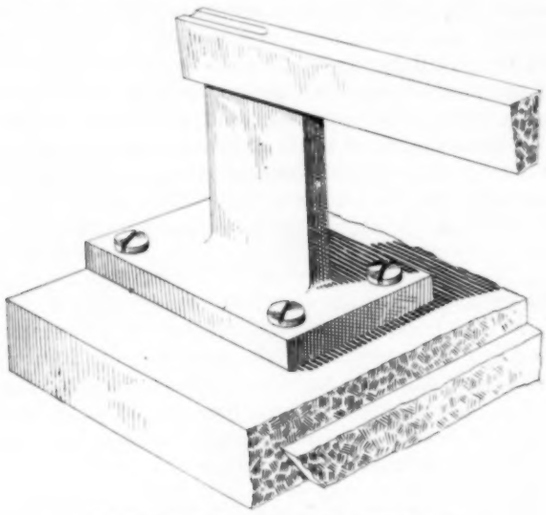
Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Cutting-Off Tools That Do Not Chatter

BY F. M. A'HEARN

The sketch shows an arrangement of cutting-off tool and support that is used in many shops building heavy machinery, and will cut off work of large diameter without noticeable chatter. The writer has seen it used upon a lathe for cutting off rolls 24 in. in diameter.



CUTTING-OFF TOOL AND SUPPORT

The tool used is of ½ by 2 in. beveled section, slightly wider at the cutting end and concaved on the top surface to narrow the chip. The steady cutting of a parting tool with the cutting edge extending 12 in. or more from the toolpost clamps and going through the entire diameter of the work at one setting without the usually attendant chatter, was remarkable. The chips passed back over the tool without displaying any tendency to wad or pack in the cut.

The height of the tool in relation to the center of the work, which affects conditions when cutting off work of small diameter where the tool is fed in to the center of the piece, does not seem to make so much difference on larger work as does the shape of the tool. The same applies to turning tools. The writer has observed that lathe men in turning work from 2 to 6 ft. in diameter rarely pay much attention to the height of the point of the tool, but they usually take care to keep the clearance as small as possible.

Some Repair Shop Uses for Babbitt

BY H. BEARD

Having to repair a large bevel gear from which several teeth had been broken out, we built up the teeth by adding metal with the acetylene torch. We then built a mold around six consecutive teeth that were in good shape and poured it full of babbitt. Before the cast was entirely cooled we pounded it on the back to make certain that it fitted the teeth and then, removing it, we had a templet to which the new teeth were fitted by chipping and filing.

At another time we had occasion to grind the bore in a number of manganese pinions. We took a pipe flange into which we screwed a short nipple of an internal diameter somewhat larger than the outside diameter of the pinions, slipped it over the tail spindle of a lathe, set one of the pinions against the faceplate and indicated it true; brought up the flange and nipple and secured it to the faceplate, stopped up all the openings except a pour hole and filled the annular space thus formed full of babbitt. This gave us a chuck into which the pinions could be slipped successively and ground, with the assurance that they would run true.

We also had trouble with a gear that persisted in slipping endwise upon its shaft and we could not afford to shut down long enough to take down the shaft and refit the key. There was a solid bearing with a smooth face several inches away from the gear hub and into this space we laid several rods, cut to the proper length to fill the space, and bound them in with twine. Wrapping a piece of sheet iron around the whole and stopping up the small openings with clay, we had a mold that we filled with babbitt. When the mold was removed there was a babbitt thrust collar between the gear hub and bearing with no dangerous screws or bolts protruding.

Fluting Screw Studs to Clean Out the Dirt

BY CHARLES MATHIAS

When using screw studs for cleaning internally threaded parts, I find it desirable to cut one or more flutes in the end, as shown in the sketch, for the purpose of removing the small particles that are liable to lodge in the threads after tapping.

The flutes can readily be cut with a small radius

FLUTING THE ENDS OF SCREWS

cutter and need extend only to the length of three or four turns of thread. They do not weaken the stud to any extent because they are cut only to a depth that is just below the root diameter.

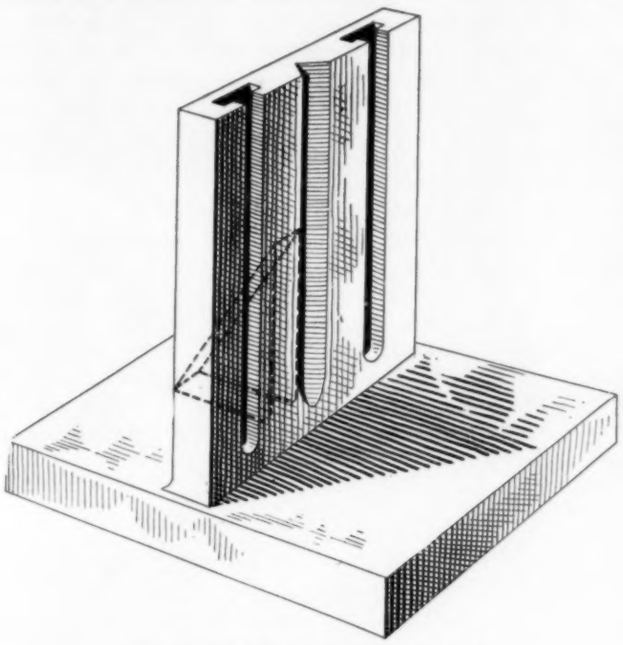
The same scheme can be used to advantage upon screws that are to be used as clamp screws on drilling or milling jigs, fixtures, and the like, and will save a deal of trouble caused by the holes becoming clogged.

Toolmaker's T, or Set-up Block

BY J. A. RAUGHT

The accompanying sketch shows a toolmaker's T, or set-up block, of the kind that the toolmaker finds very useful in laying out or setting up work that must be measured or machined at a definite distance from some fixed surface, as a bench plate or the table of a machine.

Instead of being drilled full of holes, as is usually the case, the T-slots are provided so that work may readily be clamped anywhere on its surface. The



TOOLMAKER'S SETTING BLOCK

vertical V-groove in the face facilitates the setting up of pieces having round shanks or parts. The extension base gives the tool a good firm bearing upon whatever surface it may be resting and it is not, therefore easily knocked over, to the detriment of the work clamped upon it.

Hardening Sense

BY R. MCHENRY

There is no mystery or magic about the proper hardening of tool steel. A knowledge of the material and method is of course essential, but when warped or cracked work results, it is not without some definite reason, however hidden. The frequent howl concerning spoiled work is—"it was in the steel." I also believe this to be the correct reason in a majority of cases, but it does not necessarily place any blame on the steel maker. For "it" was probably not in the steel when he shipped it. "It" was put in during the machining operations of that particular piece of work. The "it" in this case applies to the change of structure, or strains set up, incidental to the removal of surplus stock. Normalizing or simple annealing will return the stock to a state of repose. Annealing after heavy machine work, hammering, etc., is not a new scheme, it has been recommended by steel manufacturers for years. But many at the hardening tank steadily disregard it to their own detriment.

I have found that a habit of relieving the tension on *all* tool steel to be hardened, pays and pays well. The normalizing process need not be carried out as thoroughly as in the annealing of hardened work. Heating barely to a low red and allowing the piece to cool fairly slowly until it can be handled is usually satisfactory.

The better brands of steel are pretty reliable these days, but many times they are unjustly knocked.

The hardening operation must be done just as intelligently as the designing and machine work. No die ever cracked or warped without some cause somewhere and this can usually be overcome if the right system is followed.

Here are a few "Don'ts" in regard to the hardening end which many of us know but do not pay sufficient attention to: Don't rush the heating. In annealing, hardening or tempering, heat thoroughly and evenly all over. It is a well-known fact that the heating of alloy steel quickly will prevent it from hardening properly; slow heating is not detrimental to carbon steel either.

Don't overheat: The metal will not be so hard and fine grained if quenched when above its critical point. If overheated slightly put aside until cool; then reheat correctly. If greatly overheated (burnt), scrap it at once.

Don't allow the steel to soak after it has reached a red heat; the soaking should be done first, not last.

Don't quench at a falling temperature. Dipping should be done immediately the correct rising heat is obtained.

Don't harden all sort of tools exactly the same. Take into account the shape, location of sharp corners, steam pockets (which perhaps should be packed with fireclay) and thin sections. When frail pieces are to be water-hardened, a film of oil on the bath or the use of warm water, greatly lessens the danger of springing and cracking.

Don't use dirty water or dip many pieces in a small stagnant bath, expecting the last piece to be hardened like the first. The tank should be of sufficient capacity to maintain a fairly even temperature, or else have fresh liquid running in.

Don't throw work into the bath and trust to luck. Usually the heavier portions of the piece should be chilled first. Work must not lie on the bottom of the tank, but must be held near the center and continually agitated, if fresh water is not coming in.

Don't put heavy cold tongs on light pieces before dipping. The tongs will take away the heat quickly at point of contact.

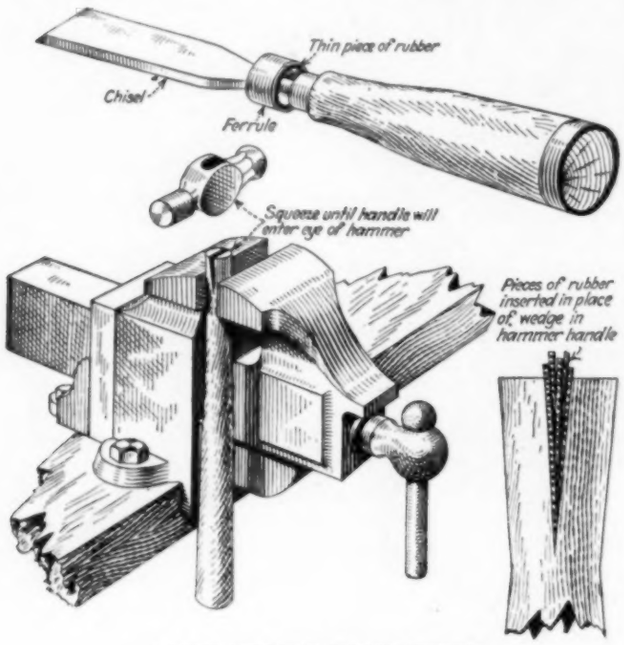
Don't leave a large die or tool in bath until the outside is cold; then toss it on the bench and be surprised if it should fly in pieces. The center may still be quite hot and exerting enormous pressure. It is a good plan to reheat the outside slightly, immediately after quenching. Many quench first in water and then in oil. I believe the less strains put in tool steel before heat-treating the better, and that normalizing does much to favor both steel and hardener.

Rubber "Wedges" to Hold Handles in Hammers

By G. L. Henderson

After experiencing considerable annoyance from having the ferrules of my chisels, gages, etc., come loose, I tried packing under them with stiff paper, but found that little relief was obtained with this means.

One day, spying an old tube from an automobile tire lying upon the floor, I cut off a piece of the thin


Thin piece of rubber
Chisel
Ferrule
Squeeze until handle will enter eye of hammer
Pieces of rubber inserted in place of wedge in hammer handle

A NEW USE FOR INNER TUBES

rubber and, wrapping it around the shoulder portion of the chisel handle, drove the ferrule over it. Since discovering this effective remedy I have not been bothered with loose ferrules.

As it worked so well in this instance I devised another application of the same method. In putting a new handle in a hammer head I first inserted several thicknesses of the rubber in the notch where the wedge is supposed to go; then squeezing the handle in a vise with about half an inch protruding I drove the hammer head over it. The rubber expands the split end of the handle and prevents the head coming off.

Brake Device Applied to a Running-Balance Machine

By Charles Kotersall

The accompanying drawings show a device used for braking or stopping a flywheel or object that is being balanced. The device was attached to a Defiance running balance machine, without changing or effecting the machine proper to any great extent.

Most manufacturers have no way to stop or brake the object that is being balanced on a running balance machine, and without braking, a flywheel or other object being balanced will sometimes run as long as fifteen minutes before coming to a dead stop. This, of course, is a lot of time wasted. With the device shown in Fig. 1 the flywheel or object to be balanced can be brought to a dead stop in less than fifteen seconds.

The only necessary changes made on the machine were on the driving disk *A*, which was turned to a diameter to accommodate the housing *B*, and the upper bearing flange *C*, which was milled off to get a square bearing surface for the housing *B* where the bolting surface rests at *D*.

The center flange *E* is bolted to the flywheel by bolts and nuts *F* with the two driven collars *G*. The female center plug *H* is hardened and ground and fits snugly into the center flange *E*. The adjusting screw *I* butts against the female center plug *H*. As the plug *H* and the male center *K* wear to an uneven or irregular surface they should be re-ground and lapped to a smooth finish. The screw *I* also adjusts for the space between the thermoid ring and work. Both centers *H* and *K* should be hard.

Before the operator places the work on the machine he must have the fingers *L* and *M* set upright, as shown in Fig. 2. The work is then placed on the male and female centers *K* and *H*. The operator must see to it that in placing the work he does not disturb or knock down the fingers *L* and *M*. The operator then brings the work against the driving fingers *L* and *M* which drive against the collars *G* thus putting the work into motion. The finger-supports *M* and *O* hold the fingers *L* and *M* which are pivoted on the pin *P*. After the work is at the proper speed, the fingers *L* and *M* will automatically kick off or release themselves by falling to the position as shown in Fig. 2.

While the flywheel is in motion the operator is chalking the wheel to get the high point or the out of balance part of the wheel. After this is done it is required to stop the flywheel. The stationary cam *Q* slides in an upward and downward movement on the four keys *U* which are seated and held in place by means of fillister head screws. The brake lining attached to the cam *Q* is thermoid and must be attached very rigidly by means of

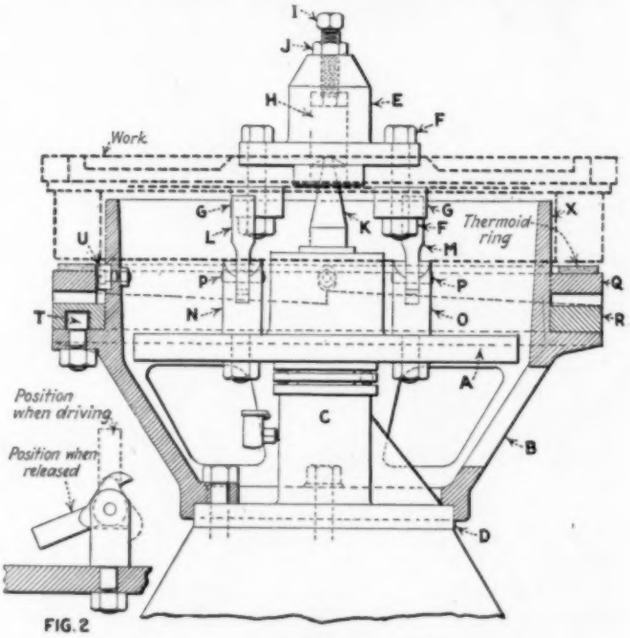


FIG. 1. BRAKING DEVICE ON THE MACHINE. FIG. 2 DRIVING AND RELEASED POSITIONS OF FINGERS

copper rivets. The lower cam *R* is operated by means of a lever in the direction in which the machine revolves, thus advancing the cam *Q*, with the thermoid

lining, upward against the flywheel rim and braking the momentum of the work, and also lifting the female center *H* off the machine center and thus bringing the work to a standstill. The housing *B* has a rim projecting up into the work at *X* acting as a pilot to prevent the work from sliding off when in motion or braking the momentum. The stop pin *T* is fastened to the housing frame *B* to prevent the cam *R* from passing beyond the four high points of the cam *Q*.

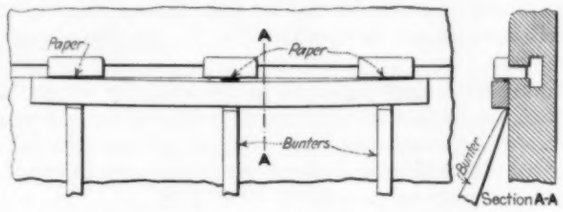
It is also understood that all revolving parts are to be perfectly balanced.

Planing Gibs Flat

BY JOHN E. HOAGLUND

On page 219 of AMERICAN MACHINIST, Tell Berna describes a way of planing gibs flat that I think is deserving of comment.

When I first learned the rudiments of planing I had as a teacher an old foreman who had spent most of his



METHOD OF CLAMPING TO PLANE WORK FLAT

life in working upon planers. The first thing he told me was: "Clamp and support your work right and you will not have to do much straightening. Avoid having to straighten the work as much as possible, for it is very difficult to straighten a piece correctly, and even if you succeed in getting it straight it probably will not remain so."

Almost any piece, especially if it is long and narrow, will not only bend but it will twist as well, so that opposite corners will be "high." On the second setting when the planed surface is in contact with the planer bed these corners, and perhaps also the middle of the piece, must be supported by packing with paper or other suitable material so that when the pressure of the clamps is applied the work will not be sprung or distorted.

Old time cards or cigarette papers make excellent packing material. Incidentally, this is the best use I have yet discovered for cigarette papers, as they are uniform and measure only about 0.001 in. in thickness.

Assuming that one of the wide sides of the gib has been planed and that it has been turned over to plane the opposite side: If now the narrow side is not straight and square (and it can not very well be so, as it has yet to be planed), it will be necessary to pack between it and the surface against which it bears, else the pressure of the clamps will distort the work not only in a sidewise direction but the under face as well, and it will be impossible to get a straight job.

My way of doing this job would be to paper up the under surface first and test it by rapping with a wrench or hammer to determine when it is properly supported, then to pack between the work and the abutting surface against which it is held at points opposite to each bunter, as shown in the cut. The bunters should be narrowed to a thickness of about $\frac{1}{8}$ in. at the end and slightly rounded.

A roughing cut should be taken over both wide sides, packing up the piece as described for each cut, and then the two narrow sides should be roughed with one of the wide planed surfaces bearing against the abutting pieces; assuming, of course, that these latter are square with the planer bed.

The same sequence of operation should then be repeated for the finishing cuts, using extreme care to see that all "high points" are properly supported in each direction before applying the pressure. To the experienced planer operator an improperly supported place in the work is instantly detected by the sound of the piece when struck lightly with the hammer.

Clamping pressure should be applied very lightly upon the finishing cuts.

Tube End Closing Tools

BY S. A. MCDONALD

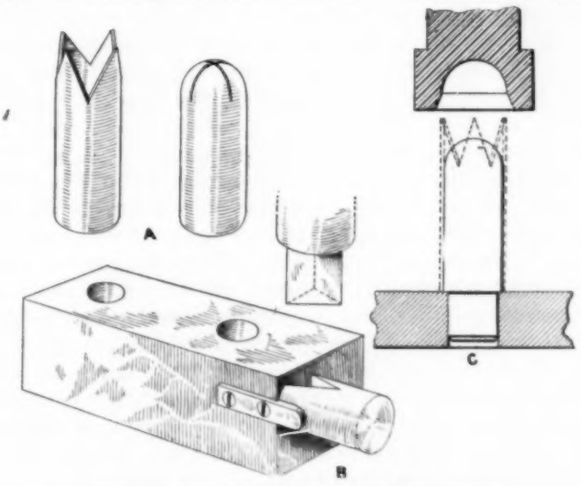
A small jobbing shop got an order to manufacture 10,000 pieces, as shown at *A* in the accompanying illustration, and made a profit because of the low tool cost.

The stock used was $\frac{3}{4}$-in. tubing with a $\frac{1}{16}$-in. wall, cut off to $2\frac{1}{4}$ in. long by a $\frac{1}{8}$-in. abrasive wheel. This left the ends with a good finish. The notching die was made from a bar of $1\frac{1}{2}$-in. tool steel planed on two sides and one end turned to fit the inside of the tube, as shown at *B*.

Before the die opening was made in the turned end of the bar, it was necessary to make the closing die to determine the shape of notch that would close perfectly. This was done by filing a tube experimentally and trying it in the closing die *C*.

The shape of the notch having been settled the opening in the die was made to correspond. A locating gage was made and secured to the side of the die, and the bolt holes drilled to secure the die to the bolster. The punch was made from a piece of tool steel, turned and milled to fit the die.

The first operation was as follows: The locating gage being removed the operator held the tube on the die against the square section, and sheared one notch in



TOOLS FOR CLOSING ENDS OF TUBES

each tube. The locating gage was then put on and the other notches cut. In the second operation the tube was placed over the plug and when the punch came down it curled the prongs in and hit the stock hard enough to spread it slightly so that the end of the tube was nearly water tight.

EDITORIALS

The Truth About the Coal Strike

THE domestic consumer of coal has evinced complete indifference to the big strike which is now three weeks old. He has little love for the coal operator whom he strongly suspects of profiteering and less sympathy for the union miners who are endeavoring to maintain their more than war-time wage rates while nearly every one else has had to accept more or less stiff reductions.

The manufacturer, on the other hand, who is apt to look farther ahead, is beginning to be somewhat apprehensive of the effect of a protracted strike on our slowly recovering business. He is interested in the merits of the case as having some bearing on the final decision and as offering some indication of the duration of the struggle.

But what are the merits of the case? In the bituminous coal industry, which should not be confused with the anthracite industry because there is no connection between them, the operators of the unionized mines, producing about two-thirds of the bituminous coal mined, are determined to force a reduction in wages sufficient to allow them to compete with the operators of non-union mines. The miners are equally determined to hold on to the gains they have made. They are entirely willing to enter an interstate conference because a national agreement is what they want as a step toward nationalization of the industry. They have made a lot of capital and gained a certain amount of undiscriminating sympathy from the daily press and in Congress by their claim that the operators have broken their contract by refusing to enter the conference which the miners were willing to take part in.

The operators on their side, claim that the miners broke their contract five months after it was signed and that the operators are no longer subject to its terms. There is little profit in the argument which is based on technicalities. However, the operators have another point to consider; more than a hundred of them are under indictment for conspiracy under the Sherman law for signing the agreement which has just expired. The operators have also offered repeatedly to meet their men in separate state wage conferences.

The operators also object to a continuation of the "check-off," a practice originally useful which has degenerated into an abuse. By it the mine unions force the operators to hold back the union dues of the miners and pay them to the union treasury, thus contributing material assistance to an organization which is fighting them in every way, even to the extent of using funds so collected in attempts to organize non-union fields.

Much has been said and done before and during the early stages of the strike to confuse the issue. The immediate problem is to deflate the coal industry to a degree somewhat commensurate with the deflation of other industries. The greater problem is to place the industry on an economic basis. On the production side there are too many high cost mines and too many miners. On the distribution side there is too great a spread between the price at the mine and the cost to the consumer. The distribution problem, of course, has nothing to do with the strike, but it must be settled before the coal situation can be called satisfactory.

In the meantime the consumer pays the bill and will be the greatest sufferer if the strike lasts very long.

Businesses Which Do Not Survive

BUSINESS depressions like the one we are now fortunately beginning to leave behind are not the only causes of business decadence. Perhaps the most deplorable cause of all is what is commonly called "dry rot"—the failure to keep abreast of the times either in machine equipment, in methods or in the handling of employees.

There are many concerns in the country which date back to the early days of centralized industry, when the relations between employer and employee closely resembled feudalism. Paternalism, the considering of employees as "my people," is still with us in too many instances.

Concerns which want to survive, which desire to keep their place in their respective industries, will do well to study carefully the question of personnel, of harmonious relations with their employees, not only today, but in the future. Those who are carefully studying industry as a whole see unmistakable signs of decay in some of the largest concerns. This frequently comes in cases of one-man management where the one man, with the greatest sincerity, believes that it is his duty to act *for* his men, instead of *with* them.

We have in mind one well-known concern of excellent repute, outside the machine industry, to which this applies. There is no question as to the honesty or sincerity of the man who directs its destiny. He is a hard working, courageous manager who honestly believes that he is ordained to act and to think for his men—that they should be perfectly willing to have him the sole arbiter of their destinies. No one else has any real authority and he refuses to see that the industrial world has advanced beyond the feudal period.

Young and ambitious men with a capacity for management in the modern way find no opportunity with him and drift away to other careers. The young blood which all concerns need, is either forced out or is congealed by repression until it is as reactionary as those in command.

We have had numerous examples of large concerns, once leaders in their line, gradually dropping by the wayside and becoming only a memory. It is perhaps the greatest danger facing a large and powerful organization. Power, backed by years of success, forgets that it became powerful by striking out with new methods, and instead, hugs the delusion that no changes are necessary.

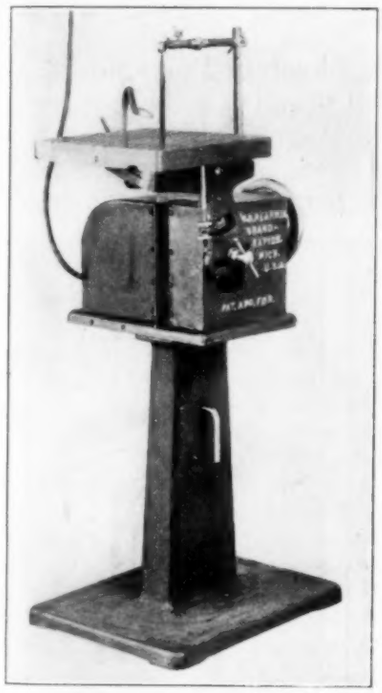
Consideration shown where it could easily be dispensed with helps to build up confidence worth much in busy times, and may well turn the balance from failure to success.

Shop Equipment News

Rearwin Nos. 3 and 4 Enclosed Die-Filing Machines

W. D. Rearwin, 716 Monroe Ave., Grand Rapids, Mich., has recently placed on the market Nos. 3 and 4 sizes of his die-filing machine, the operating mechanism of which is enclosed in a metal case. The machine is similar in principle, although smaller in size, to the No. 6 machine described on page 246, Vol. 54, of AMERICAN MACHINIST. It can be mounted on a bench or on a short column equipped with disappearing casters, the latter mounting being shown in the accompanying illustration.

The No. 4 machine is provided with a 12-in. square table arranged to tilt to all four sides, and having the swiveling mechanism graduated to 7 deg. on each side. An adjustable hold-down clamp for the work moves with the table. The position of the slide carrying the file is adjustable; also the length of stroke is adjustable from nothing up to 3 in. Speeds of 200, 300 and 400 r.p.m. are provided.



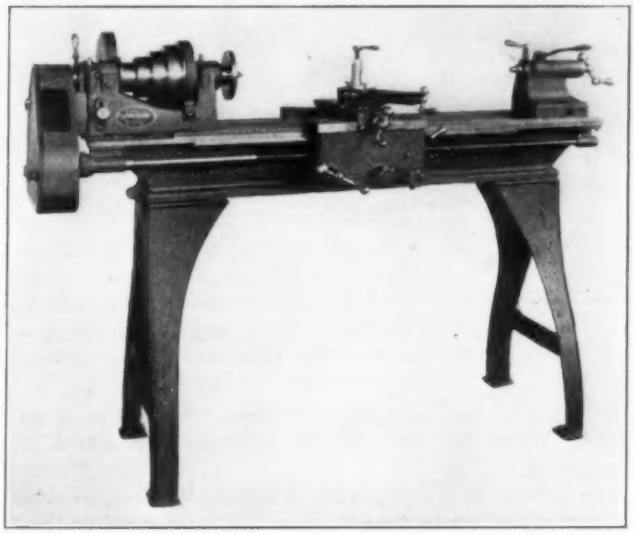
REARWIN DIE-FILING MACHINE

Both special and standard files can be used, as the upper arm has a wide range of adjustment in all directions and the machine holds securely different shapes of files. The weight of the machine separate from the motor and column does not exceed 60 lb. The No. 3 machine is the same as the No. 4 except that it is smaller, and has a 1½-in. stroke and an 8-in. square table.

Seneca Falls "Handy" Lathes

The Seneca Falls Manufacturing Co., Inc., Seneca Falls, N. Y., has recently placed on the market a screw-cutting engine lathe ranging in size from 9- to 13-in. swing and having the usual bed lengths. This machine, shown in the accompanying illustration, is known as the "Handy" lathe. It is a general-purpose machine, designed especially for the radio industry, and for starter and magneto service stations. It can be arranged for either motor or belt drive, and all the regular "Star" lathe attachments may be used in connection with it.

The bed is of heavy ribbed construction and equipped with either bench or floor legs. The headstock has back gears and a large hollow spindle adapted to draw-in chucks. Power longitudinal and cross feeds, graduated crossfeed screw, and a set-over tailstock are provided.



SENECA FALLS "HANDY" SCREW-CUTTING LATHE

A plain or compound rest, and a double friction countershaft having a cone belt shifter and self-oiling bearings can be furnished.

This company is also placing on the market a plain turning lathe having a 10½-in. swing and 3-ft. bed, and taking 12 in. between centers. The machine is equipped with a plain rest, feeds from 0.002 to 0.040 in. per revolution of the spindle, set-over tailstock, three-step cone and self-oiling spindle. The countershaft is of the tight-and-loose pulley type with roller bearings in the loose pulley. This machine is intended for plain turning where screw-cutting is not necessary, and it is especially adapted to use in the making of small parts for electrical apparatus.

Plimpton Industrial Hand Trucks

The Plimpton Truck Co., Elm Court, Stamford, Conn., has recently placed on the market the Model-E elevating transfer truck shown in Fig. 1. The construction of the truck itself can be seen in the lowest view, while a wooden platform in position on the truck is shown in the central view. The front end plate of the truck is a combined step and thrust bracket, against which the operator may press the handle to force the truck backward. Due to the radius on the end plate, the wheels can be swung while the handle is pressed against the plate. The stop for the platform extends across the entire width of the truck, so that wear on the ends of the wooden platforms is not excessive.

The loaded platforms are released by pressing the pedal only. It is not necessary to bring up the handle in order to start the action of the cams. The hook and link mechanism consists of a single connecting link pivoted on a cam section, which is depressed over an

FIG. 1. PLIMPTON MODEL E ELEVATING TRANSFER TRUCK AND PLATFORMS

offset hook on the elevating lever when the load is to be raised. When the elevation is complete, the handle is disengaged.

The handle is automatically retained in the vertical position when not in use; the mechanism for doing this is a spring-loaded plunger operating in a tongue on the heel of the lever. The truck is made in capacities of 3,000 and 4,000 lb., with platform sizes of 7 x 18 x 36 to 7 x 18 x 52 in. for the former and 7 x 20 x 36 to 9 x 20 x 52 in. for the latter.

The platform can be made of wood, with four metal feet secured by means of screws. Detachable steel platforms, such as shown at the top of the illustration, can be employed. The top plate of the steel platforms may be from $\frac{3}{16}$ to $\frac{1}{2}$ in. in thickness. The side channels may be employed in the size and weight necessary for the work. The feet are of steel and bolted in place. The channels are spaced so as to allow 2 in. side clearance for the truck. The platform may be easily dismounted. It can be furnished for any truck length in standard widths of 24, 30, 36, 42 and 48 inches.

The truck shown in Fig. 2 is a heavy-duty, non-elevating platform style for use especially in foundries and machine shops where heavy, compact loads are handled. The truck has a wide wheel base and steering knuckles of the automobile type, so that it is practically impossible to upset the truck by too heavy loading on one side.

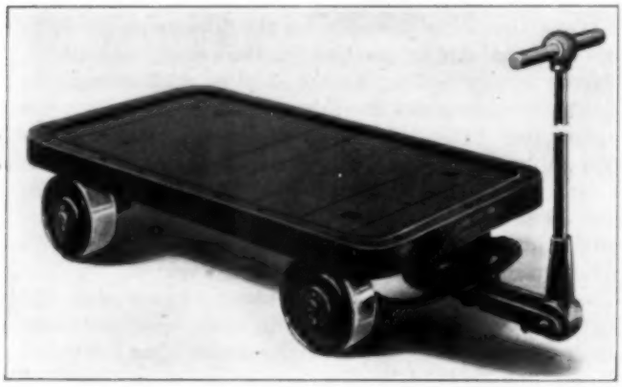


FIG. 2. PLIMPTON HEAVY-DUTY PLATFORM TRUCK

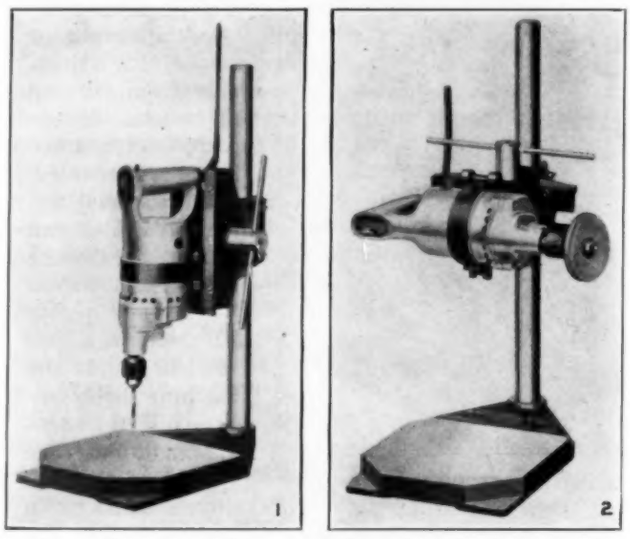
The wheels can be provided with either ball or roller bearings. The top is made of heavy oak planks and bound by angle iron at the edge, the corners being rounded. The handle is normally held in a vertical position by a spring-loaded plunger. The truck may be furnished to steer on either two or four wheels.

The truck is made with load capacities of 2,000, 3,500 and 5,000 lb. In the smallest size, platforms 18 in. wide and from 36 to 52 in. in length are provided, with a height of 8 in. In the medium size, the truck can be furnished in heights of either 8 or 10 in.; the platform is 20 in. wide and varies from 36 to 52 in. in length. In the largest size, the platform is 24 in. wide and varies from 44 to 72 in. in length. The height is 10 in. The net weights range from 161 to 352 pounds.

Both styles of trucks just described can be equipped with wide flanged wheels, so that they can be used either on rails or directly on the pavement or ground of the yard or building. In this way, the flexibility is increased, as the trucks are adapted to both indoor and outdoor work.

Petersen "Hole Shooter" Portable Drill Stand

The A. H. Petersen Manufacturing Co., Milwaukee, Wis., has recently placed on the market a portable drill stand for use with the "Hole Shooter" electric drill.



FIGS. 1 AND 2. "HOLE SHOOTER" PORTABLE DRILL STAND

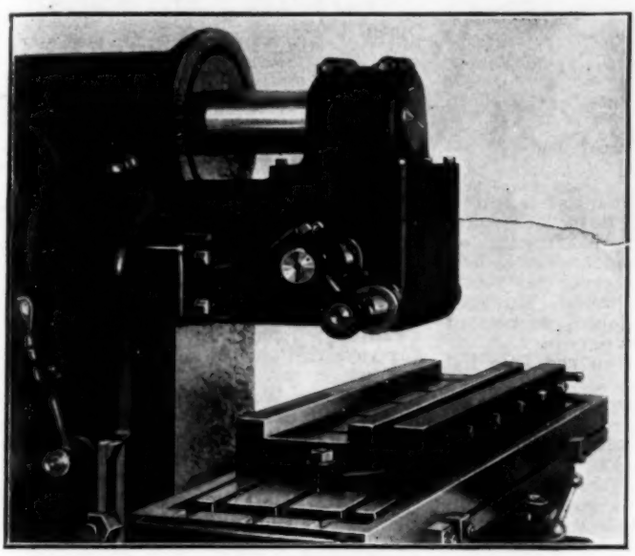
With the drill vertical, as shown in Fig. 1, the combination serves as a bench drill. With the motor swung to the horizontal position, Fig. 2, the device can be used as an electric grinding machine, or for buffing or polishing. Many other applications are possible, due to the fact that the spindle of the machine can be set to operate at any angle. The adjustment is easily made after loosening the setscrews.

The base of the stand is of cast iron, with a finished table 8 x 8 in. The upright is of $1\frac{1}{4}$-in. cold-rolled steel. The range of travel of the slide is 12 in., and the range of travel of the rack in any one position is $3\frac{1}{2}$ in. The weight of the stand is 30 pounds.

The design and construction of the stand permits the elimination of springs for controlling the rack travel.

Rockford Rack-Cutting Attachment

The Rockford Milling Machine Co., Rockford, Ill., has recently developed the rack-cutting attachment shown in the accompanying illustration for use on its milling machine. The attachment is intended primarily for the purpose of milling racks, but is not limited to this work alone. It is simple in design and rigid in construction. It clamps to the face of the column of the machine, and is further supported by means of the overhanging arm



ROCKFORD RACK-CUTTING ATTACHMENT

above the spindle. The method of clamping provides rigidity, even when taking the heaviest cuts within the capacity of the machine. The attachment is intended especially for use on the heavy-duty milling machine, but can also be furnished to fit the No. 1½ machine.

The attachment is driven from the main spindle of the machine through wide-face, hardened spur gears, driving the pinion keyed to the double-lead worm. The worm is of alloy steel, and provided with ball thrust bearings. A heavy bronze wormwheel of coarse pitch has keyed to it two wide-face spur gears with staggered teeth, providing a smooth drive. Spur gears are cut directly on the spindle, one very close to the front and the other to the rear bearing.

The spindle is of alloy steel and runs in tapered bronze bearings. A single nut provides means of taking up wear on these bearings. A solid shaft runs through the entire drive mechanism and carries a bearing at each end, so as to serve as an overarm support for the cutter arbor. The worm and all gears run in a bath of oil.

A rack indexing attachment and rack vise can also be furnished. The rack-indexing attachment is fastened to the T-slot at the left-hand end of the table, and consists of a bracket which carries an indexing and locking disk with change gears. It provides for cutting racks and making settings without relying on the dials of the milling machine.

The various gear combinations permit racks of different pitches to be indexed, by making either one-half turn, one complete, or two complete turns of the locking disk. Eighteen change gears provide for cutting diametral pitches from 3 to 6 by half pitches, all pitches from 7 to 16 and all even pitches from 18 to 32; also circular pitches from ⅛ to 1 in., varying by ⅛ in. The rack vise has jaws 36 in. long and will open 5⅝ inches.

Atlantic Simplex Safety Stop

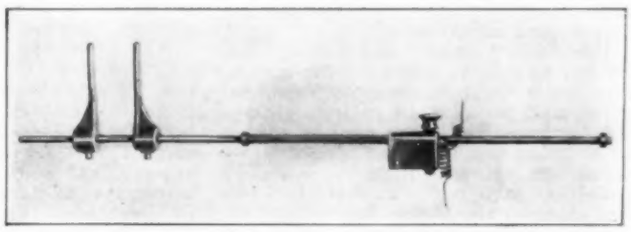
The Atlantic Co., 452 Classon Ave., Brooklyn, N. Y., has recently placed on the market the Simplex safety stop shown in the accompanying illustration. The device is intended for attachment to automatic machines of many types, so as to stop them in case of irregularity or breakage of the work, or change in tension size, speed or some other condition of operation.

The device is operated by current from either a battery, a generator, or the regular lighting circuit. It is wired in series with a Mazda lamp, which remains unlighted normally because the circuit is open. The circuit is closed when the shifter is caused to operate by the irregularity in the work. However, a circuit breaker instantly opens the circuit, so that only a surge of current is necessary. The contact points are thus left without current when the stop has acted, so that there is no danger of the operator coming in contact with the live leads.

A latch in the stop holds a notched shifter rod that keeps the belt in the running position. Wires run from the stops to the contact points that are placed where the trouble may occur in the machine or work. If these points close the circuit the latch is released, and the spring in the rod immediately moves the belt to the loose pulley or disengages the clutch. When the magnets in the stop are energized by current, an armature is drawn out of position so as to release the levers and latch. A hand stop entirely independent of the electrical connection is provided.

The stop can be furnished for either 6 or 110-volt current, either a.c. or d.c. It is made for ½, ⅝ or ¾ in. shifter rods. A spring providing any force up to 75 lb. can be utilized, so that it is possible to shift a 6-in. belt. The stop itself is 3¼ x 2⅝ x 2⅛ in. in size.

The stop may be mounted on the machine in many different ways, and different forms of contact points can be employed. It may be set to give the same effect as the action of a treadle or hand lever. The size of machined work may be controlled to within 0.001 in. by

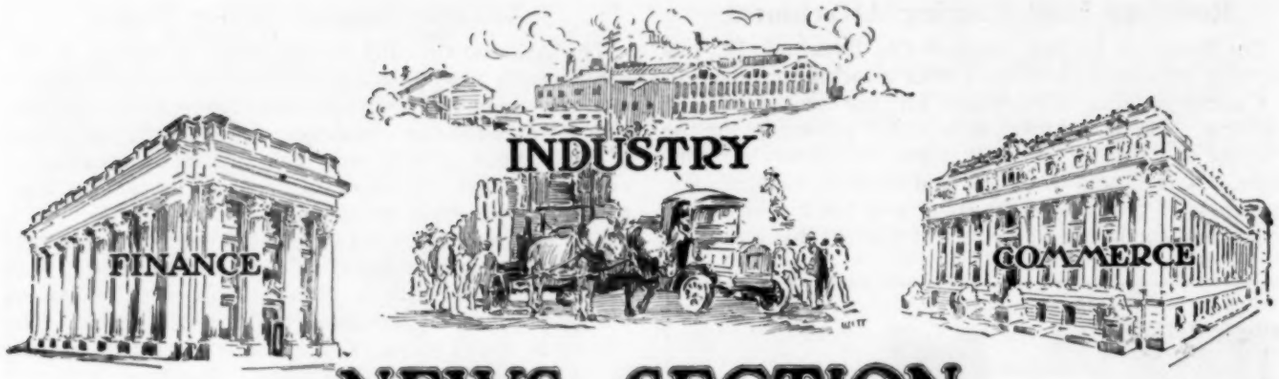


ATLANTIC "SIMPLEX" SAFETY MACHINE STOP

using the needle of a lathe indicator to complete the electrical circuit. Breaking or knotting in threads or wires being fed continuously can be caused to operate the stop.

Machinist Retires at 102

When Andrew Rafferty, for many years employed as a machinist for the Baltimore & Ohio Railroad at its Washington, Ind., shops, retired a short time ago, there was much discussion as to how old he was. He would give no information on the subject himself so his friends started an investigation which resulted in the discovery that he was 102 years old. He received his naturalization papers in 1864 when he was forty-five years old.



NEWS SECTION

Senate Committee Approves House Tariff Rate on Machinery

A tariff duty of 35 per cent ad valorem for machine tools and parts of machine tools, which had been prescribed by the House of Representatives, was approved by the Senate Finance Committee in the bill reported on April 11. Steam engines and locomotives were given a rate of 20 per cent ad valorem by the Senate committee, an increase of 5 per cent over the rate prescribed by the House. The Senate added to the machinery paragraph, the following:

"Sewing machines, and parts thereof, not specially provided for, valued at not more than $75 each, 25 per cent ad valorem; valued at more than $75 each, 40 per cent ad valorem.

"Cash registers, and parts thereof, 25 per cent ad valorem.

"Printing presses, not specially provided for, 35 per cent ad valorem.

"Lawn mowers, 35 per cent ad valorem.

"Knitting, braiding and insulating machinery, and all other textile machinery, and parts thereof, finished or unfinished, not specially provided for, 50 per cent ad valorem."

Embroidery and lace-making machines, as well as machines for making lace curtains, nets and nettings, are given a 30 per cent ad valorem rate by the Senate. The same rate is applied to all other machines not specially provided for. In this latter case it is a reduction of 5 per cent from the rate contained in the House bill.

The machine tool item is subject to the usual proviso to the effect that "machine tools means any machine operated other than by hand power, which employs a tool for work on metal."

The bill provides that in addition to the duties ranging from one cent per pound to three and one-half cents per pound on steel suitable for toolmaking, an additional duty of 10 per cent ad valorem shall be provided when the steel contains more than six-tenths of 1 per cent of nickel, cobalt, vanadium, chromium, tungsten, molybdenum, or any other metallic element used in alloying steel. An additional cumulative duty of 72 cents per pound is levied on the tungsten content in excess of six-tenths of 1 per cent. A cumulative duty of $1.25 per pound is levied in addition on the molybdenum content of steel in excess of six-tenths of 1 per cent.

Anti-friction balls and rollers, metal balls and rollers used in ball or roller bearings, as well as the bearings themselves, whether finished or unfinished, are given a duty of 10 cents per pound and 55 per cent ad valorem. The Senate raised the ad valorem portion of the rate from 35 to 55 per cent.

Among the articles on the free list are the following:

Agricultural implements: Plows, tooth or disk harrows, headers, harvesters, reapers, agricultural drills and planters, cultivators, thrashing machines, cotton gins, machinery for use in the manufacture of sugar, wagons and carts, centrifugal cream separators operable by hand power, and all other agricultural implements of any kind or description, not specially provided for, whether in whole or in parts.

Temporary Receivership for Rivett Lathe and Grinder Company

As a result of the general business depression the affairs of the Rivett Lathe and Grinder Company have been placed in the hands of a receiver. The court has authorized the receiver to continue production without a break. The sale of receiver's certificates has provided ample funds for operation and the factory is now running on an increased schedule with the original personnel. The company is ready to receive and fill orders as usual and expects that a reorganization will soon terminate the receivership as assets are conservatively estimated to be three times liabilities.

Automotive Exports Gain

Total exports of automotive products from the United States during February gained 23 per cent over January, according to figures compiled by the automotive division of the Department of Commerce. A decrease of 2 per cent in number and 15 per cent in value of motor truck shipments was more than offset by an increase of 38 per cent in the value of motor vehicle parts exported as well as a gain of 29 and 26 per cent respectively in the number and value of passenger car shipments. Passenger cars valued below $800 and over $2,000 and motor trucks up to one ton and above 2½ tons capacity made the best showing. Shipments of electric cars and trucks decreased nearly two-thirds.

Courts Decide Government Suits Over War Contracts

The Bethlehem Steel Co. has been awarded $67,000 from the government for royalties on its patents on machinery which were used by the Government at the Watervliet Arsenal. This is a result of a decision of the U. S. Supreme Court in affirming the decision of the Court of Claims, holding that the steel company was entitled to this recovery. The Government appealed the case to the Supreme Court, but on April 10 Justice McKenna, for the court, sustained the Court of Claims in its award to the steel company.

The Court of Claims has dismissed the petition of the Poole Engineering and Machine Co., Baltimore, Md., against the Government for the recovery of $225,000 for excess labor and overhead costs on account of government gun carriage contracts. The suit was based on the claim that the Ordnance Department delayed deliveries of material for the work and also made numerous changes in the plans which added to the cost of manufacture.

Senate Grants $10,000 for Standardization of Farm Machinery

The Senate has adopted an amendment to the agricultural appropriation bill appropriating $10,000 for co-operative investigations by the Department of Agriculture and the Bureau of Standards of the Department of Commerce, looking to standardization and simplification of farm implements and machinery and repair parts, with a view to their more economical manufacture and use. Senator France, of Maryland, proposed the amendment, which provides for investigation by the Agricultural Department and urged the necessity for standardization and simplification of farm machinery. Senator Jones, of Washington, pointed out that the Department of Commerce, through its Bureau of Standards, was already engaged in standardization work, and that it could take up farm machinery. Senator Jones proposed a modified amendment for carrying on the work by the two departments, whereupon it was adopted. Senator King, of Utah, opposed extreme standardization on the ground that it will curb inventive genius.

Editors Have Busy Day at Washington

The meeting of the National Conference of Business Paper Editors on April 13 was of particular interest. In a brief meeting in his office, General Dawes told of the work of co-ordinating the activities of the different departments of the Government so as to conserve resources and avoid duplications. With General Dawes as a guide the editors went to the White House and were presented to President Harding, as a body who had co-operated fully and earnestly with the department in its endeavor to dispose of surplus property of the various war activities.

This was followed by a meeting in the Department of Commerce, presided over by James H. Defrees, to discuss the data and experiences which had arisen as a result of the Unemployment Conference. As was pointed out by Mr. Stone, of Rochester, the elimination of seasonal work as a cause of unequal employment, was more a merchandizing than a production problem, E. E. Hunt, secretary of the Unemployment Conference, spoke of the desirability of co-operation and the desire to publish data which would be of real value, rather than a book which looks well on the shelves but is never consulted. Ernest F. DuBrul spoke of the use of data on business cycles, the tendency to consider peak production as normal and the necessity of knowing costs.

Following this was a meeting at which Col. Roosevelt, Assistant Secretary of the Navy and Admiral Coontz spoke. Both pointed out that the reduction of the Navy to 67,000 men, as proposed by the Senate, would bring it below the 5-5-3 ratios. Both contended that personnel was the main thing in the Navy and asked for 96,000 men. Admiral Coontz pointed out that navy officers did much for foreign commerce, an admiral in Constantinople at the present time being the only means of business communication with Turkey. In speaking of the close relation between the Navy and business he said: "War is only commerce carried beyond a certain stage."

The usual dinner meeting with Secretary Hoover ended the program.

Cincinnati Letter

The shops in the Cincinnati territory are running about the same as they were a week ago. A few have added to their working forces. The Wm. Powell Co. is busy installing equipment in its new plant on Colerain Ave. The Cincinnati street railway directors have ordered the traction company to put on more cars to accommodate the workers during the early morning and late evening hours on the line running to the Oakley factory colony. The Newport Rolling Mill and the Andrews Steel Co. report that they are running 100 per cent of their pre-war capacity and that prices have advanced on their products.

The demand for used equipment during the last week has not been as large as in some weeks in the past, but prospects are very good. The manufacturers of radio apparatus are busier than they ever were before, and cannot keep up with the ever increasing demand. The general outlook is that April business will be at least as good as March.

Comparison of Proposed and Existing Tariff Duties

The following figures are taken from a complete list of proposed tariff duties and the present figures of the Underwood Law as published in the *New York Times* of April 12. In this list the unit of taxation, as weight, volume, square or cubic measure, or ad valorem is stated after the name of the article.

	Senate Bill	House Bill	Underwood Law
Pig iron (ton)	$1.25	$1.25	Free
Scrap iron and steel (ton)	$1.00	$1.00	Free
Molybdenum (lb.)	75c.	75c.	Free
Tungsten ore (lb.)	45c.	43c.	Free
Ferromanganese (ton)	$2.50	2.2c. lb.	Free
Manganese metal (%)	20	2.2c. lb.	10
Ferromolybdenum (lb.)	$1+15%	$1+17%	15%
Tungsten compounds (lb.)	60c.+25%	72c.+15%	15%
Tungsten alloys (lb.)	60c.+25%	72c.+15%	15%
Ferrosilicon, 8-30% silicon (lb.)	2c.	2¼c.	15%
Ferrosilicon 30-60% silicon (lb.)	2c.	2¼c.	15%
Ferrosilicon, 60-80% silicon (lb.)	3c.	3 1-3c.	15%
Ferrosilicon, 88-90% silicon (lb.)	4c.	4c.	15%
Ferrosilicon, over 90% silicon (lb.)	8c.	8c.	15%
Ferrochrome, 8% chrome (lb.)	3½c.	3½c.	15%
Ferrochrome, under 3% chrome (%)	30	30	15
Other steel alloys (%)	30	30	15
Cerium metal (lb.)	$2.00	30%	30%
Cerium alloys (lb.)	$2+25%	30%	15%
Bar iron (lb.)	0.2-1½c.	0.2-1c.	5%
Steel ingots, &c. (lb.)	0.2c.-25%	0.2c.-20%	Free
Steel bars (lb.)	0.2c.-25%	0.2c.-20%	15%
Steel circular saw plate (lb.)	½c.	½c.	12½%
Boiler plate (lb.)	7-20c.-20%	7-20c.-20%	12½%
Sheet iron or steel (lb.)	45-100c.-20%	45-100c.-20%	12½%
Coated iron on steel sheets (lb.)	0.2c.	0.2c.	15%
Structural steel (%)	30	25	10
Hoop and band steel (lb.)	25-100c-35%	25-100c.-20%	35%
Coated hoop and band steel (lb.)	½c.	½c.	Free
Wire rods (lb.)	0.3-0.6c.	0.3-0.6c.	10%
Steel wire (lb.)	½c.-40%	½c.-30%	10-25%
Galvanized wire (lb.)	½c.	½c.	15%
Anti-friction balls (lb.)	10c.—55%	10c.—35%	35%
R. R. fish plates (lb.)	½c.	½c.	10%
Other R. R. bars (lb.)	7.40c.	7.40c.	Free
Steel axles (lb.)	0.6c.	0.6c.	10%
Steel R. R. wheels (lb.)	1c.	1c.	20%
Seamed steel tubes (lb.)	½-1½c.	½-1½c.	20%
Flexible metal tubing (%)	35	25	20
Chains (lb.)	½c.	½c.	20%
Machine chains (%)	50	30	25
Nuts and washers, (lb.)	0.6c.	0.6c.	5%
Bolts, (lb.)	1c.	1c.	10%
Spiral nut locks, (%)	40	30	30%
Rivets and studs, (%)	40	25	20
Other steel rivets, (lb.)	1c.	1c.	20%
Iron or steel grit, (lb.)	½c.	1c.	30%
Jewelers' saws, gross	40c.	40c.	12½%
Steel printing plates, (%)	25	15	15
Needles, per M	$1.15+40%	$1.15+25%	20%
Latch needles, per M	$2+50%	$2+35%	2?%
All other needles, (%)	45	30	20
Laboratory instruments (%)	50	40	Free
Nippers and pliers (dozen)	8-12c.+50%	8-12c.+25%	30%
Files (dozen)	25-77½c.	25-77½c.	25%
Swiss pattern files (%)	50	25-27½	25
Watch movements	$1.25-$10.75	$1.25-$10.75	30%
Watch case and parts (%)	50	35	30
Clocks and clock movements	50%	35%	30%
Same with jewels	$1-$3+50%	$1-$3+35%	30%
Clock parts (%)	55	40	30
Automobiles and parts (%)	25	25	30-45
Airplanes and motorboats (%)	30	30	*
Bicycles (%)	45	30	25
Motorcycles (%)	25	30	25
Steam engines and locomotives (%)	20	15	15
Sewing machines under $75 (%)	25	Free	Free
Sewing machines over $75 (%)	40	Free	Free
Cash registers (%)	25	Free	Free
Printing presses (%)	35	35	15
Embroidery machines (%)	30	35	25
Textile machinery (%)	50	35	25
All other machines (%)	30	35	25
Aluminum, crude (lb.)	5c.	5c.	2c.
Aluminum, plates, bars, &c. (lb.)	9c.	9c.	3½c.
Magnesium, metallic (lb.)	50c.	$1	25%
Magnesium, alloys (lb.)	50c.+20%	$1+20%	25%
Antimony metal (lb.)	2c.	1½c.	10%
Bismuth (%)	2?	Free	Free
Cadmium (lb.)	15c.	Free	Free
Liquidated antimony (lb.)	½c.	Free	Free
German silver (%)	20	20	15
Nickel silver (%)	30	20	15
Copper rolls (lb.)	2½c.	2½c.	9%
Brass rods, &c. (lb.)	4c.	4c.	20%
Seamless brass tubing (lb.)	8c.	8c.	20%
Brazed brass tubes (lb.)	12c.	12c.	20%
Bronze rods and sheets (lb.)	4c.	4c.	20%
Bronze tubes (lb.)	8c.	8c.	20%
Quicksilver (lb.)	25c.	35c.	10%
Nickel in pigs (lb.)	3c.	5c.	10%
Nickel bars and sheets (%)	25	30	20
Tin in bars and pigs	Free	2c. lb.	Free
Lead bullion and pigs (lb.)	2½c.	2½c.	25%
Lead in sheets (lb.)	2½c.	2½c.	25%
Zinc-bearing ore—			
Under 10% zinc	Free	Free	10%
10@20% zinc	½c.	½c.	10%
20@25% zinc (lb.)	1c.	1c.	10%
Over 25% zinc (lb.)	1½c.	1½c.	10%
Zinc in pigs (lb.)	1½c.	1½c.	15%
Zinc in sheets (lb.)	1½c.	1½c.	15%
Zinc in plated sheets (lb.)	2c.	1½c.	15%
Old zinc (lb.)	1c.	1c.	15%
Other metal articles or wares (%)	40	35	20@50%

The Machine Tool Market in Italy

By LUIGI MARZOLI

The metal working industries of Italy have experienced a great deal of trouble since the end of the European war. The heavy burden of our political mistakes has struck several bad blows to the young Italian industries, and particularly to the metal working branches.

No doubt you have noticed the greatest of our industrial griefs—when the workmen seized the factories. The result, however, was morally good, because the experiment has shown plainly the impossibility of running an industrial organization under socialistic laws and regulations. Since that time our workmen have become more reasonable in their demands and more efficient in their work, and it has been possible to purge the factories of the bolshevist elements.

We now have the great evil of taxation which is altogether too high and which is a tremendous handicap to all our industries. This is not only the case in Italy, but generally throughout Europe. However, our country leads all in taxation per capita and we are confident that our powerful allied creditors will show wisdom in trading with us, and in so doing aid business relations.

Our government has voted to seize all excess war profits, and this law has resulted in great difficulty for all those firms which had invested enormous amounts of money in new plants and equipment, but the government had to satisfy the radicals. The people have been disturbed by the length of the war and the unsatisfactory results, so something had to be done, even though it added more men to the armies of unemployed.

Labor unrest, heavy taxes, and in some cases poor management have ended in a very bad situation for some of our large mechanical industries like Ansaldo and Ilva. The average condition of these industries is one of hopeful waiting for better business. Very few are working at all, and those who have orders are working with reduced forces and on short-time schedules. There has been a great scarcity of waterpower due to the very dry winter.

The motor car builders have also suffered from lack of orders, which is partly due to the high internal taxation on car licenses. Fortunately this tax has now been reduced to about one-half and the motor car industry is registering improved business. It is worth mentioning here that the automobile industry is one of the most extensive industries in Italy and the automobile factories are the most fertile market for American machine tools.

The machine tool building industry in Italy was developed very little during and since the war. Firms like Tassoni, Zust, Michele Ansaldi, Dubosch and a few others have produced some well designed tools, but altogether there is no real competition. The strongest competitors in our markets for machine tools are the German manufacturers, but as our engineers prefer American built machines I believe it would be advisable for the American machinery and machine tool builders' associations to endeavor to make a commercial treaty with Italy, and thereby assure a special low tariff on imported American machine tools. Since July 1, 1921, Italy has applied a new general tariff rate on imports of machine tools. This rate imposes a duty of from 40 to 112.50 gold liras for every 100 kilos between 5 and 10 tons. Automatic machine tools carry an extra duty of from 15 to 50 per cent, according to the weight of the machine. Small tools such as taps, dies, reamers, milling cutters and twist drills are charged according to the weight from a minimum of 100 to a maximum of 540 gold liras. This new tariff is not very high, but the difficulty is that it must be paid in gold, which under the present exchange is four times the old rate.

It has been noticeable that very little business in the machine tool line has been done in this country since the middle of the year 1920, and we do not see any signs of improvement. In 1921 there were almost no inquiries for machines of any make. The situation in the small tool market is not quite as bad, and in spite of the keen German competition American and English made tools lead in the Italian market. American and English made files dominate the Italian shops and twist drills are also exclusively of American or English make. German made twist drills are now being introduced, but past experience has proved that they are of inferior quality. In Trieste during 1920 it was impossible to sell any but the German makes of tools, mainly because of their low price, but in 1921 American and English made tools were consistently inquired for because it was learned that the average German tool was of a very low standard. Most of the German machines introduced in Italy after the war were poor copies of American built machines. Of late, though, German designs have been greatly improved.

Regarding tool steel and special alloy steel it is remarkable the laxity of almost all American and English makers, who have done nothing to hold the priority which they had in Italian markets immediately after the war. In this field the German manufacturers have displayed wonderful organization in opening large stores with plenty of stock and giving the steel users the best attention and assistance in order to popularize their several brands of tool steel.

There is one field in the mechanical industries which shows some prosperity during these dull times. That is the application of scientific instruments in our shops. The managers of our factories have come to realize the wonderful results to be obtained by the application of modern control methods and testing apparatus, and if they cannot afford to buy new machine tools they have at least kept up to date with American made instruments of this particular class.

Business Outlook in Foreign Markets

Cable dispatches and other reports coming from representatives of the Department of Commerce in foreign countries, indicate a continued, though slow resumption of business. The demand for American products is good, but is retarded somewhat by the depreciated foreign currencies and the fluctuating exchange rates.

Czecho-Slovakia shows considerable activity in the iron and steel trade. Three companies have merged their selling organizations into what is called the "Combined Iron and Steel Works," and other concerns are expected to join in the movement. The purpose of the organization is to regulate the production and marketing of iron and steel products and to encourage trade with foreign countries.

In order to promote foreign trade the syndicate reimburses domestic machine shops which purchase iron from it, to the extent of 40 crowns per 100 kilos of iron—providing the finished product was shipped abroad.

The combine was started by the Prague Iron Works and has been joined by the Vitkovice Iron and Steel Works and the Austrian Iron and Steel Works.

The Japanese government (lower house) has passed a bill providing for the rapid extension of railways all over the empire. Large sums will be expended for equipment and improved service facilities.

In Belgium, iron and steel production is gradually showing improvement. Production for February was in metric tons: Pig iron, 91,710; raw steel, 78,870; rough castings, 5,130; finished steel, 81,870; finished iron, 7,751.

In Thrace, agricultural development is calling for modern implements and especially for tractors. There are about seventy-five tractors in use there at present, one-half of these being American.

A bill recently presented to the Spanish legislature provides for reductions in duties on several items including iron, steel and machinery and equipment. It is expected that the bill will receive favorable attention.

Industrial fairs and exhibitions are to be held at Munich, Germany; Marseille, France; Valencia, Spain, and Lausanne, Switzerland, during the next few months. American products will be shown at all of these.

Welding Society Meeting

Plans have been completed for the annual meeting of the American Welding Society, to be held in the Engineering Societies Building, New York City, on April 26, 27, 28 and 29.

The program has been laid out to cover a wide range of subjects pertinent to welding operations and the speakers have been chosen from the foremost in that field. Committees on various specifications and standardizing projects will report their findings. Various kinds of welding and welding apparatus will be explained and discussions allowed so as to bring out the sentiment of the organization.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
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In so far as domestic business is concerned the most important event of last week was an oversubscription to an offering of $150,000,000 six months Treasury Certificates bearing interest at only 3½ per cent.

Almost concurrently the Bank of England reduced its rate to 4 per cent and, although the Federal Reserve Bank statement showed no change in the reserve ratio or otherwise, the impression is strengthened that we are in for a long period of easy money on both sides the Atlantic. In New York the best commercial paper is salable at 4½ per cent, and eligible bank acceptances are quoted at 3½, while 90-day bankers acceptances are readily marketable in London at 2½ per cent.

An early reduction in the Federal Reserve rate for rediscounts is therefore confidently expected, some issues of Liberty Bonds have sold at par or higher, the market for other bonds is described as "boiling" and both railway and industrial shares have been very responsive to rumors or announcements that could be plausibly construed as bullish.

The Trade Balance

Sentiment on the Stock Exchange has in fact become almost unanimously optimistic, and the textile strike, the coal strike and a foreign trade statement for March, which shows an excess of exports of only $74,000,000 as compared with $134,000,000 in the same month last year, have been entirely ignored.

Of course cheap money is a powerful tonic, but it is questionable whether it can permanently overcome the dispiriting influence that the idle cotton mills and coal mines exert, and if the strikes last much longer the prevailing enthusiasm over the outlook may be chilled. Thus far there is but little indication that either the employers or the employees are disposed to yield or compromise. As to our foreign trade it has been for some time evident that we could not continue to export more than we import, but there is a traditional fear of an "adverse trade balance" in the United States and however logical it may be, its psychological effect may also be "adverse."

It is, however, probable that the impetus the upward movement has acquired will enable speculators to "carry on" for some time yet and while I would again advise those who use borrowed capital in their business to cover their prospective requirements at present rates and as far ahead as possible, there is as yet no reason to expect any serious reversal in the upward tendency of the security market.

As always at such periods, there is much talk of mergers, consolidations and other "deals" to excite the public imagination, and there is good reason to expect that in so far as the railroads are concerned some important consolidations are being very seriously considered.

Turning from finance to commerce and industry the most surprising item in the week's news is the domestic cotton consumption for March, which shows an increase when everyone expected a decrease as a result of the New England strike.

This brings the total domestic consumption of cotton from Aug. 1 to April 1 to 4,002,975 bales as compared with 3,170,592 bales during the same period last year, and furnishes convincing proof of the recovery that has taken place in one of our most important industries.

Exports are also running heavier, a very serious shortage of cotton goods is reported from Germany, as well as from other Continental countries, and the outlook seems to indicate an eager demand for as much cotton as the South is likely to produce next season.

The woolen industry has also been invigorated by an interview with President Wood of the American Woolen Co. in which he stated that "we are on the very brink of prosperity." His faith in this declaration is evidenced by the action of his company in advancing woolen cloths by from 10 to 45 cents a yard. Several leaders of the steel industry have expressed themselves in the same strain as to the future of their business, and nearly all the steel fabricating plants are now at work. Raw silk and silken textiles are also higher. Coffee has gone well above ten cents a pound for May delivery. Sugar is firm despite the bearishness of some trade authorities. The National Lumber Trade Barometer says that "production is not keeping pace with the demand" and prices are higher. Building materials have again advanced. Bradstreet's estimates the authorized expenditure for new construction in March at $234,000,000, as against $118,000,000 in the same month a year ago, and a serious shortage of mechanics is reported from many of the larger cities.

Automotives Prosperous

The automobile manufacturers seem to be confident of a big demand for cars. Gasoline is higher. So is rubber, and the retail stores patronized chiefly by the women compose about the only trade group that is not confidently cheerful. Possibly the prosperity has not reached to the outermost circumference of the business circle as yet, or possibly those who buy new cars can't buy new clothes also, but when the crops are marketed the money realized will probably find its way into the tills of the retail shops.

The only serious shadow athwart the future is a tariff bill that pleases nobody, and which if passed will probably reduce our exports because it will make imports almost impossible. The bonus bill still threatens also, but there is reason to hope that the dominant element in Congress has been made more cautious by the recent by-elections in Connecticut, Illinois and New York, and that its ear is now so close to the ground that it can hear the protests of the business men against these two measures.

All other foreign developments have been obscured by the Genoa Conference, where the friction that has from time to time occurred led Lloyd George to remark that "there is nothing so explosive as a peace conference." It is too early to say what will result from the gathering, but the fact that Russia, Germany and the Allies are now at the same council table is auspicious, and despite an occasionally acrimonious interchange of views there is every reason to hope that the conference will prove to be another milestone on the road to the economic reconstruction of Europe.

This hope is encouraged by the action of the foreign exchange market, which is distinctly firmer for sterling, francs and lire.

From the cable reports it would appear that Lloyd George, John Maynard Keynes and some others at Genoa are still disposed to think that European inflation can be corrected by the "revaluation" or "devaluation" of the paper currency outstanding, but this idea is regarded as visionary and the best opinion is that it will only be possible to stabilize exchange by reopening all the world's markets to trade.

If this can be accomplished the prosperity now so generally expected will be a fact, but America will not share it unless her people and her legislators are willing to admit the truth as stated by Lloyd George when he said:

"The world is one economic unit. Economically it is not even two hemispheres. It is one round unbroken sphere."

W. N. Best, Inventor of Oil Burners, Dead

William Newton Best, president of the W. N. Best Furnace and Burner Corporation, of New York, and the holder of many patents for inventions in the oil-burning industry, died on April 11 at his home in Brooklyn. He was in his sixty-second year. He was the author of "Science of Burning Liquid Fuel" and was a fellow of the Royal Society of Arts, London, and a member of the American Society of Mechanical Engineers, the American Institute of Mining and Metalurgical Engineers, the American Institute of Metals, the American Railway Mechanics' Association and was vice-president of the Goodwill Industries of Brooklyn.

The Trend of Business Improvement—Plants Resuming

The Wincroft Stove Works, Middletown, Pa., is maintaining close to capacity production at its plant, with a night force working in a number of departments. Present orders total approximately 50 per cent in excess of those at this same time a year ago.

The Earl Motors, Inc., Jackson, Mich., manufacturer of automobiles, has resumed operations in all departments of the plant. This is the first time that production has been on this basis for a number of months.

The Timken Roller Bearing Co., Canton, Ohio, has adopted a night shift in addition to regular day operation in all departments at its plant.

The Reading Iron Co., Reading, Pa., has increased the wage scale of puddlers at its plant from $6 to $6.50 a ton. The wages of laborers have been advanced from 22½ to 24½ cents an hour. The plant is maintaining active production under regular operating schedule.

The Osgood Bradley Car Co., Worcester, Mass., will increase its working force by 300 to 500 men. The plant is operating on a 48-hour week schedule, giving employment to about 1,000 men. The company has just received an order for 98 steel coaches from the Boston & Maine Railroad, at a contract price aggregating $2,000,000.

The Warner Gear Co., Muncie, Ind., is arranging for the early resumption of operations at close to normal capacity. Additions will be made to the working force.

Dodge Brothers, Detroit, Mich., manufacturers of automobiles, are perfecting arrangements for an increase in manufacture from 600 to 750 cars per day.

The Studebaker Corporation, South Bend, Ind., manufacturer of automobiles, is maintaining full capacity operations in all departments, and in May will increase the output of closed-type cars to 100 a day, representing about 25 per cent of the production of all styles. An appropriation of $1,250,000 has been arranged for plant expansion, to include the erection of a storage and shipping building to cost about $750,000, with equipment, and a power plant to cost $500,000.

The Chickasaw Car Co., Birmingham, Ala., is increasing operations at its plant to handle current orders. The company has secured a contract for 50 cars from the Atlantic Coast Line Railway, and will repair 3,000 cars for the Seaboard Air Line Railway. Negotiations are being closed for a portion of a 2,000 freight car order from the Louisville & Nashville Railroad.

The Pennsylvania Railroad Co. has increased operations to close to normal at its Todd's Cut, Del., car shops. Two hundred men have been added to the working force during the past fortnight, bringing up the working quota to about 1,000 employees.

The Warner Corporation, Muncie, Ind., manufacturer of automobile parts, has adopted a day and night production schedule, giving employment to about 350 men. The bulk of output is for the Durant Motor Co.

The Durant Motors, Inc., New York, is operating its plants at Long Island City and Lansing, Mich., on a capacity basis, and has plans in progress for enlargements at both factories for the establishment of departments for the manufacture of the new Star automobile. It is proposed to develop a total output of 20,000 cars a month. The bulk of operations will be devoted to assembling.

The Edward G. Budd Manufacturing Co., Philadelphia, Pa., manufacturer of all-steel automobile bodies, has adopted a capacity operating schedule at its plant, with night shift working in certain departments. The company has secured sufficient orders to insure this basis of production for about ten months to come.

The General Motors Corporation is adding to the working force at its Muncie Products Co. division, Muncie, Ind. About 900 men are now employed and this number will be increased each week. Other units of the company at this place are now giving employment to approximately 600 operatives.

The Liberty Motor Car Co., Detroit, Mich., has adopted a capacity schedule at its plant, with sufficient orders on hand to insure operations on this basis until well into July. The plant was reopened in February after a shut down of a number of weeks, and has increased the output twice since this time.

The Elliott Blair Steel Co., Mercer, Pa., has inaugurated capacity production at its plant, with the employment of two shifts of workers.

The Upson Nut Co., Cleveland, Ohio, has adopted a full time, full production schedule at its bolt and nut department.

The Logan Iron and Steel Co., Burnham, Pa., has adopted a full-time operating schedule in all departments at its plant. The company has orders on hand for staybolt iron and other material for locomotive construction.

The White Motor Co., Cleveland, Ohio, is increasing operations at its plant and will add about 150 men to the present working force.

The Pennsylvania Railroad Co. is increasing the number of employees at its car and locomotive shops at Renovo, Pa., including machinists, blacksmiths, boilermakers, pipe fitters and car repairmen. Additions will also be made in the working force at the Northumberland, Pa., shops. Both plants will revert to a pre-war basis of operation.

The Southern Pacific Railroad Co., Chicago, Ill., is taking bids for the construction of 2,000 single-sheathed, steel superstructure automobile cars of 50-tons capacity, comprising the largest order for this class of equipment ever placed by a western railroad.

The Lindstrom Tool and Toy Co., 50 Silliman Ave., Bridgeport, Conn., recently added one hundred and fifty employees in the toymaking department.

The Ashcroft Manufacturing Co., Bridgeport, Conn., subsidiary of Manning, Maxwell & Moore, Inc., report increased orders, necessitating hiring additional help. The plant is working steady.

Department of Agriculture as Aid to Farmer in Selecting Machinery

Increased activity in rural engineering problems is proposed by the Department of Agriculture. Prof. E. D. Ball, director of scientific work of the department recently asked the Senate Committee on Appropriations to increase from $33,000 to $48,000 the appropriation for rural engineering work. He says this work contemplates the possibility of improving the designs of warehouses, including storage cellars for sweet potatoes, deciduous fruits, farm buildings, farm machinery, etc. With the farmer spending millions for tractors, there are requirements for farm machinery to go with the tractors.

Dr. Ball also points out that the farmer is spending a large amount of money on buildings and machinery that do not pay. The department proposes to secure a rural engineer for this work but is handicapped by the $4,500 salary limitation. The American Association of Farm Machinery Manufacturers has endorsed the work, as it desires the department to study farm machinery and determine what is a most desirable type of farm machinery to use with a certain type of tractor. At present no one knows which is the most economical type of machine or plow or harrow necessary for the tractor. There is a desire to standardize farm machinery and reduce the number of extra parts of machines. It is said that the farmers could be saved millions of dollars a year if farm machines were placed on a standard pattern so that an extra part would fit one machine as well as another.

Robinson Company Makes Safety Record for 1921

The employees of the H. H. Robinson Company plant at Ambridge, Pa. have been awarded the Rice Safety Award bronze tablet by the National Safety Council. The company has achieved what was thought to be impossible—a year without accident and no lost time by workmen through such mishaps. The award was made at the fourth annual banquet of the Western Pennsylvania division of the council, which was held in Kaufman's in Pittsburgh.

W. E. Megraw, safety director of the Robinson company, received the tablet in the name of the employees. Twenty-five members of the company's staff attended the ceremonies.

Engineers to Travel on Gas Railway Cars

The Metropolitan Section and the New England Section of the Society of Automotive Engineers will hold a joint session on April 21. The members from New York will go to New Haven via gasoline driven rail cars, through the courtesy of the New Haven Railroad. The session will be devoted to a study of this comparatively new type of rail transportation. The engineers will have luncheon at the Yale University Dining Club at noon and will be addressed by Prof. Lockwood of the Yale laboratories.

Legislation To Convert Battleships to Airplane Carriers

The House Committee on Naval Affairs in reporting the naval appropriation bill for the year beginning July 1, 1922, recommends that two of the battleships and two of the battle cruisers to be scrapped under the naval limitations treaty, be converted into airplane carriers.

It gives the comparative costs for hull and machinery for completing the battleships and cruisers and for converting them into carriers for airplanes. It estimates that it would cost $115,000,000 for hull and machinery to complete the two battleships and the two battle cruisers and fifty-nine smaller vessels. To alter and complete two battle cruisers as aircraft carriers would cost for hull and machinery $31,887,000. It estimates that it would cost $48,000,000 for hull and machinery to build two aircraft carriers complete.

The Navy had estimated $53,000,000 for construction and machinery for naval vessels which was made unnecessary by the naval limitation treaty.

The bill, introduced by Represented Butler on April 7 follows:

A BILL

Authorizing the president to Scrap Certain Vessels in Conformity with the Provisions of the Treaty to Limit Naval Armaments, and for Other Purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress Assembled, That for the purpose of giving effect to the provisions in the treaty to limit naval armament, concluded Feb. 6, 1922, by the United States of America and the British Empire, France, Italy, and Japan, respecting the abandonment of shipbuilding programs and the scrapping of capital ships in excess of the number which the United States may retain in conformity with the said provisions, the President of the United States be, and he is hereby, authorized to make such disposition, as in his judgment may be proper, of any capital ship of the Navy built or building and to cause to be taken such action as is necessary for the scrapping of capital ships to be dealt with in that manner in accordance with the said provisions.

Sec. 2. That the President of the United States is hereby authorized and empowered to discontinue the construction of and to cancel or modify any contract entered into for and on behalf of the United States for the construction of seven of the first-class battleships and the six battle cruisers authorized in the Act entitled "An Act making appropriations for the naval service for the fiscal year ending June 30, 1917, and for other purposes," approved Aug. 29, 1916, and for the machinery, materials, equipment, armor, armorment, and ordinance equipment therefor: *Provided,* That whenever any such contract is canceled or modified just compensation therefor shall be made in the manner and upon the basis provided in the Act of July 1, 1918, entitled "An Act making appropriations for the naval service for the fiscal year ending June 30, 1919, and for other purposes," out of any funds hereafter to be appropriated for that purpose.

Sec. 3. That of the battle cruisers authorized in the Act entiled "An Act making appropriations for the naval service for the fiscal year ending June 30, 1917, and for other purposes," approved Aug. 29, 1916, the President of the United States is hereby authorized to undertake the conversion of the two battle cruisers now building which in his judgment are furthest advanced in construction, or will be the most economical to convert into airplane carriers, within the limits of cost heretofore authorized for said battle cruisers; and the President is hereby further authorized to utilize any such funds and materials that may be on hand or under contract at this time for the construction of battle cruisers heretofore authorized.

Proposed Merger of Machine Tool Concerns

THE proposed merger, mention of which was made in the March 23 issue, has not gone through.

An announcement has been made by the Lodge & Shipley Machine Tool Co., Cincinnati, Ohio, that it is not in any merger or combination, but will be operated independently as in the past, under the management of J. Wallace Carrel, vice-president and general manager.

A similar announcement has also been made by the Carlton Machine Tool Co., of Cincinnati. This company will continue to be operated independently under the management of Jack C. Carlton, president and general manager.

Chicago Letter

There is a rather cheerful spirit of optimism among the machine tool dealers in the Chicago district and according to all indications April promises to far exceed the past three months in the amount of business. In general, the orders booked are from widely scattered sources and very few of them are large.

No reports have come of the railroads buying in the past week, although their inquiries for machinery have become more pronounced. As usual the list is topped by the Santa Fe. This road has added some thirty or thirty-five machinery requirements to its outstanding list. An extensive list from the Illinois Central remains among the expectations of the dealers. This road, however, recently purchased a 15-ton pillar crane from the Whiting Corporation.

Activities continue strong in the steel industry. Last month was looked upon as a banner month.

Building permits for 1,327 buildings involving a cost of $19,333,900 were issued in Chicago during March. This cost practically exceeded all others since August, 1911. The marked increase in construction was also felt in other lines; for instance the Common Brick Manufacturers' Association of America, in its monthly digest, reports that the deliveries of brick through the months of February and March were at a rate that promises a season's output closer to normal than has been experienced in the last two years. This sounds a little like a statement made by a local manufacturer and dealer in machine tools to the effect that he could, after many months, truthfully say that business was satisfactory and somewhat pleasing.

The Rail Joint Company received an order for a number of 100 per cent rail joints from the Chicago, Indianapolis & Louisville R.R.; one for 1,250 rail joints from the Chicago & Eastern Illinois R.R.; and another for 18,000 joints from the Atchison, Topeka & Santa Fe. There is also a report that the Illinois Steel Company received an order from the Wabash Railroad for 160,000 tie plates.

The entire assets and liabilities of the L. A. Allthoff Co., of Illinois, have been taken over by the L. A. Althoff Manufacturing Co., Inc., Laporte, Ind. It is understood the corporation recently completed a plant and is in the market for a few machine tools and other equipment.

The Crown Foundry Co., East Peoria, Ill., a recently incorporated concern, is erecting a plant at East Peoria, and will manufacture gray iron, chilled and semi-steel castings. This company is in the market for complete equipment for the new plant.

A slight ray of hope has been placed by the machine tool dealers on the recent rumor of an increase in the price of steel.

Cleveland Letter

Another indication of the comeback in industry in the Cleveland, Ohio, district, is the announcement last week that the Sterling-Knight Motor Company is preparing to produce the Sterling-Knight automobile at an early date. Negotiations for the purchase of the Accurate Machine Company's plant, in the east end of the city, were completed. This part of the project alone involves $1,000,000 officials state. The company is headed by P. H. Withington, and the mechanical developments are under direction of J. G. Sterling, formerly chief engineer of the F. B. Stearns Company, of Cleveland. It is planned to build the complete chassis of cars in the plant. Already 200 cars have been sold, officials assert. Plans call for starting deliveries during August.

Plans for opening its Canton, Ohio, plant are being considered by officials of the Hydraulic Pressed Steel Company, of Cleveland. Both Cleveland plants are running day and night forces since the number of orders for steel building material, automobile parts and the like have increased.

Test of Airplane Wing in Flight

A full-sized airplane wing suspended below an airplane in high-speed flight will be tested at the Langley Field laboratory of the National Advisory Committee for Aeronautics. This will be the first time that a real wing has been tested in actual flight, and is the final step of developing a new method of testing the performance and lifting properties of airplane wings.

The method recently demonstrated successfully with model wings in air flights, consists in carrying the wing to be tested below an airplane in flight and, by means of suspension apparatus and recording instruments, to measure the forces of lift and resistance directly from the wing.

A complete airplane cannot be tested in flight as there is no means nor method of measuring the factors desired; there is nothing to suspend the plant from and its lift or pull cannot be measured by instruments carried on the plane itself.

Business Items

Announcement has been made of the division of the Lynn, Mass., works of the General Electric Company into two sections, to be known as the West Lynn Works and the River Works. F. P. Cox has been appointed manager of the West Lynn Plant and Nelson J. Darling manager of River Works, both succeeding Richard H. Rice, deceased, who formerly exercised control over the entire plant.

The stockholders of the Century Machine Co., Holyoke, Mass., have voted in favor of a plan to reorganize the company and largely increase the capital stock. The company manufactures machines for washing and sterilizing dishes and glasses.

The Palmer Steel Co., has been formed at Holyoke, Mass., with $100,000 capital, to design, fabricate and erect steel structures in the nature of bridges and buildings. It is stated that the concern has bought its machinery and will soon let the contract for a one-story building 80 x 200 ft., to be located in Williamsett, a suburb of Holyoke. Earl Palmer of Memphis, Tenn., is president of the company; Wayne E. Palmer of Holyoke is treasurer, and Raymond E. Palmer of 316 High St., Holyoke, is vice-president and general manager.

The Holyoke Water Power Co., Holyoke, Mass., is preparing plans for the electrification of the headgates at its big dam on the Connecticut. Hitherto they have been operated by a Boyden waterwheel and this will be retained for emergency use. The headgates are thirteen in number, and are operated singly. The company has filed plans for two electrical sub-stations, one to cost $900 and the other $400.

The Monarch Machine Tool Co. is considering the installation of a sprinkler system in its plant at Sidney, Ohio.

The Vaughn & Son Boiler and Machinery Co., Joplin, Mo., has purchased the firm of Robbins & Long, same city. The two plants will be combined at the Vaughn works on Grand Ave.

The Whiting Corporation, of Harvey, Ill., has moved its Chicago sales offices from 1245 Marquette Bldg. to 945 Monadnock Bldg.

The East plant of the American Tube and Stamping Co., in Bridgeport, Conn., will reopen about the middle of May. This plant has been closed since February, 1921. At a recent meeting of the directors of the company Edmund C. Mayo was elected president; F. Kingsbury Curtis, vice-president; C. P. Miller, treasurer; W. L. Warrell, secretary. New directors chosen were W. L. Abbott, R. F. Cutting, W. B. Day, C. L. Dimon, F. J. Kingsbury, E. E. Macy, J. V. W. Reynders, C. J. Sanford, Carlton Macy and W. R. Webster.

The New England Tube and Stamping Co., Inc., West Haven, Conn., has been incorporated under the laws of Connecticut, to manufacture automobile accessories, metal tubes and machine parts, sheet metal goods, etc. The capital stock is $200,000. The company will operate in the plant of the Coe-Stapley Manufacturing Corporation, the assets of which were recently purchased by P. J. Holdsworth, of New York. The incorporators of the new company are Mr. Holdsworth; J. M. Harding, 178 Lawrence St., New Haven, Conn.; and Robert R. Adams, Bridgeport, Conn.

The Connecticut Marine Boiler Works Co., 64 Kossuth St., Bridgeport, Conn., recently added the manufacture of a combination metal door and lock, to its present business. The door and lock has been patented by Mr. Wilson, president of the company, who states that his company already has an unusual large order for the product. The company will also engage in the manufacture of tin and galvanized iron appliances.

The assets of the Hartford Automotive Parts Co., Broad and Lawrence Sts., Hartford, Conn., will be disposed of by public auction at the offices of the company on May 3rd. The trustee states that no bid under $325,000 will be considered.

The Dalton-Ingersoll Manufacturing Co., manufacturer of plumbing goods, etc., Boston, Mass., has recently removed from 175 High St., into more commodious quarters at 365 Atlantic St.

The Welker Manufacturing Co., Middletown, Conn., has recently been incorporated to manufacture metal specialties. The capital stock is $50,000, and the incorporators are: O. B. Welker, 199 South Main St.; F. A. Beach and F. B. Fountain, all of Middletown.

John E. White was chosen president and general manager of the Graton & Knight Manufacturing Co., Worcester, Mass., at the recent annual meeting. Mr. White succeeds Walter M. Spaulding, who has been elected chairman of the board of directors. Five men were elected to the board of directors. They are: Harry G. Stoddard and Dr. Homer Gage, of Worcester; Stanley A. Russell, George B. Greene and W. R. Grace, of New York city.

At the annual meeting of stockholders of the American Electric Fusion Corporation, Chicago, Ill., it was decided to increase the capital stock of the concern to $40,000. New officers elected were: E. J. Henke, president; A. B. Bonneborn, vice-president; S. F. Strand, secretary-treasurer.

The Everyday Piston Ring Co., Inc., has purchased the building formerly occupied by the Kleen Sweet Products Co., at Commercial & Roosevelt Streets, Rochester, N. Y. The company has made many alterations to building and has installed specially made machinery and equipment for the manufacture of piston rings. Officers of the company are: George E. Burgess, president; F. E. Paige, vice-president and general manager; E. H. Perkins, secretary and treasurer.

The Rockford Milling Machine Co., Rockford, Ill., has made the following announcement: The Mid-West Machinery Exchange, Kansas City, Mo., will handle in the Kansas City territory the complete line of Sundstrand lathes, manufactured by the Rockford Tool Co. The English Tool and Supply Co., Kansas City, Mo., will handle the cone-drive millers. The Peden Iron and Steel Co., Houston, Texas, will handle the Rockford line exclusively in the state of Texas; the Greensboro Supply Co., Greensboro, N. C., will handle the Rockford line exclusively in North and South Carolina.

Personals

EDWARD BLAKE, JR., vice-president of the Greenfield Tap and Die Corporation, who has been general manager of the organization's drill plant at Taunton, Mass., has been placed in charge of sales and will hereafter make his headquarters in Greenfield. Mr. Blake was connected with Wells Bros. for several years and at one time was vice-president and general manager of the Lincoln Twist Drill Co., before that concern was sold to the Greenfield corporation.

K. W. ZIMMERSHIED has been appointed to assist P. S. DuPont, president of the General Motors Corporation.

WILLIAM S. KNUDSEN has been elected vice-president of the Chevrolet Motor Co. He will be in charge of operations.

DONALD MCSKIMMON has been elected treasurer of the J. T. Slocomb Co., Providence, R. I.

JOHN G. WOOLCOTT has been appointed buyer of the E. W. Webb Manufacturing Co., manufacturer of plumbers' goods, Boston, Mass. Mr. Woolcott succeeds C. W. Coleman, who recently resigned.

VOORHIES HAIGHT, formerly of the sales department of the Bridgeport Brass Company, Bridgeport, Conn., has accepted a similar position with the Waterbury Manufacturing Co., Waterbury, Conn.

M. W. MELROSE has opened a machine shop in the Washington Garage, Brookline, Mass., where he will do cylinder grinding, crankshaft grinding and toolmaking.

HARRY C. KINNE, head of the engineering department of Bagley & Sewall Co., manufacturers of paper mill machinery, has returned to Watertown from a 10,000-mile business trip through the Western States. In commenting on business conditions governing the machinery interests, Mr. Kinne stated

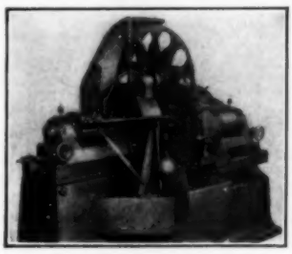
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Vise, Bench, U-Beam
Athol Machine and Foundry Co., Athol, Mass.
"American Machinist," Jan. 5, 1922

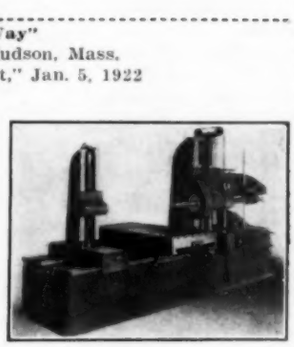
The vise has jaws of tool steel and a screw of the buttress type operating in a malleable-iron nut. The beam, eye and ball are unfinished. The vise is made in four sizes, with widths of jaws of 2½, 3, 3½ and 4 in. The jaw openings are, respectively, 3½, 4½, 5½ and 6 in., and the weights 13, 21, 30 and 37 pounds.

Grinding Machine, Automatic, Double, No. 1
Gardner Machine Co., Beloit, Wis.
"American Machinist," Jan. 5, 1922



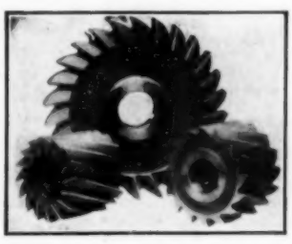
The machine is adapted to rapid grinding of piston rings, ball and roller bearing races, sad-iron sole plates, thrust washers and similar parts. The openings in the work carrier can be made to conform to the shape of the work. The carrier is provided with a range of feeds from six to forty pieces per minute. A handwheel adjusts the grinding members. Provision is made for accurately aligning the spindles of the machine. Steel collars carry the thrust. When grinding small work at a high rate of feed, an automatic feeding device for the carrier is employed.

Boring Machine, Horizontal, "Tri-Way"
Universal Boring Machine Co., Hudson, Mass.
"American Machinist," Jan. 5, 1922



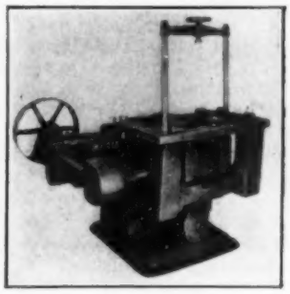
In this machine three instead of two guiding ways are provided for the carriage. The lever controls are grouped in the head end. The base extending beyond the head provides a rigid support for the motor. All speed and feed change gears are located in two flat removable trays. The bar-carrying heads move up and down simultaneously and can be fed by power in either direction. Power crossfeed is provided for the table, as is also power traverse to the carriage. Automatic knockouts are provided. The machine is made in two sizes, with three lengths of bed. Spindle speeds, 7 to 284 r.p.m. Feeds, ¼ to 5⅛ in. per minute. Floor space, 17 ft. x 9 ft. 5 in. Height, 8 ft. Weight, 20,000 pounds.

Milling Cutters, "Parabolic"
National Twist Drill and Tool Co., Detroit, Mich.
"American Machinist," Jan. 5, 1922



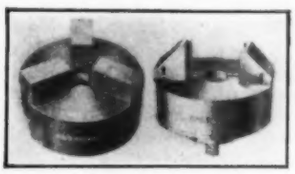
The cutter tooth to give uniform strength throughout is a parabola slightly modified at the small end. The number of teeth used is nearer to that of the conventional fine-tooth cutter than that of the coarse-tooth type. To secure the most effective chip thickness per tooth without excessive peripheral speed, a fairly large number of teeth was found desirable. The parabolic cutters are made in plain side and end-mill types, as well as in special designs.

Milling Machine, Straddle, Cycle-Feed Type, C-75
Newton Machine Tool Works, Inc., Philadelphia, Pa.
"American Machinist," Jan. 5, 1922



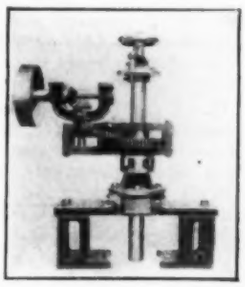
The machine is used in facing the bearings for crankshafts in automobile cylinder blocks. It is driven by a belt. The two spindles have individual hand adjustment for setting the face-milling cutters. The motion of the table is a rapid advance downward, a slow feed for the cut and an upward quick return to the loading position, where the table automatically stops on the level of the conveyor rolls. The table is provided with hardened steel jig plates. The rate of feed, or the time of one cycle, may be varied.

Chucks, Air-Operated, "American"
S-P Manufacturing Co., 872 East 72d St., Cleveland, Ohio
"American Machinist," Jan. 5, 1922



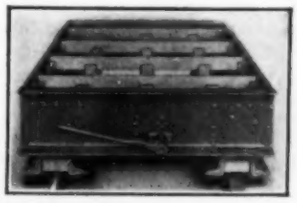
The standard sizes of the chucks range from 6½ to 18 in. in capacity, but larger chucks can be furnished. In the accompanying illustration are shown the three-jaw and two-jaw combination chucks. Special jaws or master slides to take false jaws can be furnished. The chuck bodies are made of one-piece semi-steel castings. The strain of the work bears on the end of the machine spindle. The air may be shut off in the cylinder and the work still firmly held. The chuck can also be hand operated.

Boring Unit, Portable
Pedrick Tool and Machine Co., 3638 North Lawrence St., Philadelphia, Pa.
"American Machinist," Jan. 5, 1922



The device consists of the bar, the feed mechanism, the driving gear and the crosshead mechanism. The bar is 3 in. in diameter and 3 ft. long, and has a travel of 18 in., while the lower end of the bar is bored out with a taper hole to hold tools. By blocking the motion of the handwheel, the feed becomes automatic. Two changes of feed are ordinarily provided, although three may be furnished for special work. Power may be applied by belt, motor, or hand. The crosshead supports the guide for the bar. Space blocks provide room between the work and the end of the bar. Setscrews center the bar in the hole.

Tables, Truck, Work
Edwin Harrington, Son & Co., Inc., Philadelphia, Pa.
"American Machinist," Jan. 5, 1922



The table is used with straight-rail or fully adjustable multiple-spindle drilling machines for moving the work from under the machine entirely, or in small steps to obtain any desired indexing. The device may be furnished with any surface dimensions, number of wheels, character of top surface or method of movement. It can be supplied with a cast-iron top with T-slots and pin holes. On the inside of the frame vertical slots hold 4 x ½-in. work-supporting bars, which are covered with planks, so that the cutting tools may easily penetrate. A hand ratchet lever at the front drives the front wheel of each truck. A compound-wound direct-current motor controlled by a push-button automatic starter can be mounted below the table and geared to the drive wheel shaft, to move the table 60 in. per minute.

that the Western States were where the Eastern section of the country was six months ago.

F. G. BATCHELOR, formerly with the Union Twist Drill Co., Athol, Mass., has gone to the Lincoln Twist Drill Co., Taunton, as superintendent of plant equipment.

At the last meeting of the Engineering Club of the Greenfield (Mass.) Tap & Die Corporation a purse of gold was presented to James F. Dunnigan, who has been in the employ of the concern for fifty years.

CHARLES C. RAMSDELL, vice-president of the Gilbert & Barker Manufacturing Co., has been made a director of the Union Trust Co., Springfield, Mass.

CHARLES WOODWARD, secretary of the Industrial Association of Cleveland, recently addressed the Rochester Industrial Management Council, Rochester, N. Y. His topic was "Industrial Leadership."

BYARD L. CLEGG, machine tool engineer of the Westinghouse Electric and Manufacturing Co. gave an illustrated lecture on March 28, to the students of the Brooklyn Edison Co. School on the subject "The Application of Electric Motors and Control to Machine Tools."

FRANK DUBSKY, for eight years with the transformer engineering department of the General Electric Co. in Pittsfield, has been appointed chief electrical engineer for Kolben & Co., in Prague, Czecho-Slovakia, and will begin his new duties on July 1.

E. A. MOORE, president of the Stanley Works, New Britain, Conn., has been elected a director of the Colt's Patent Firearms Co., of Hartford, Conn.

CHARLES R. HARE, for several years production superintendent of the New Britain Machine Co., New Britain, Conn., has been promoted to general superintendent.

HERBERT H. PEASE was elected president and treasurer of the New Britain Machine Co., at the meeting of the stockholders held last week. Abram Buol resigned as vice-president.

H. M. DARLING has resigned as superintendent of the Bicknell-Thomas Co., Greenfield, Mass., and has opened a shop of his own, where he will build special machinery, tools and dies. He will be located at 90 Wells Ave., Greenfield, Mass.

J. A. LEIGHTON has renewed his connection with the Lucas Machine Tool Co., Cleveland, Ohio, and will have charge of the Eastern territory.

R. S. COOPER, vice-president and general manager of the Independent Pneumatic Tool Co., Chicago, Ill., will sail from New York on April 22 for Europe. He will spend some time visiting the company's agencies and branch offices in Continental Europe.

W. C. AMES has been appointed district sales manager in the Chicago territory for the Sharon Pressed Steel Co., of New York. He will be located at 20 East Jackson Blvd., Chicago.

RALPH E. PHILLIPS has been appointed district sales manager in New York for the Sharon Pressed Steel Co.

H. R. HENRY has been appointed general sales manager of the Standard Motor Car Co., Columbus, Ohio. He was formerly connected with the Hudson-Essex interests.

ELMER MACDOWELL, of Leroy, N. Y., sailed from New York on April 13 for Japan, to become foreign manager of the American Aluminum Co. Mr. MacDowell's headquarters will be at Tokio. The company's designation for this branch is the Asia Aluminum Co.

HARRISON W. FITZGERALD, mechanical engineer with the Donner Steel Co., has been elected president of the Village of Hamburg, N. Y.

JAMES F. DOLAN, formerly division superintendent of the Willys-Morrow Corporation's plant at Elmira, N. Y., has left that connection and is now with the International Motor Co., New Brunswick, N. J.

DEXTER S. KIMBALL, Dean of the College of Engineering, Cornell University, and president of the A. S. M. E., has been appointed a member of the board of visitors of the U. S. Naval Academy at Annapolis. The appointment is for one year.

RALPH BARSTOW, general sales manager of the Greenfield Tap and Die Corporation, has established himself in business in New York City. Mr. Barstow, with his partner Marquis Regan, will conduct a marketing and merchandising business at 21 East 40th St.

Obituary

BERTRAM LAMOND, manager of the plant of Lamond Bros., Washington, D. C., was instantly killed in that plant on April 6. A part of Mr. Lamond's clothing was caught in a machine and he was drawn into the gearing before the power could be shut off.

WALDO A. LOUD, president of the Worcester Lawn Mower Co., manufacturers of lawn mowers and agricultural implements, Worcester, Mass., dropped dead in that city on April 4. Death was due to heart failure.

Trade Catalogs

Files of Precision: American Swiss File and Tool Co., sales office Edward P. Reichhelm, New York City, N. Y. An interesting booklet giving a history of the making of Swiss files and the company manufacturing them. It is put up in very handy form, and the information is arranged in an easily read manner. Several pages of illustrations are given, showing the special features of American-Swiss files and offering comparisons with other commercial makes. Another section is devoted to "How to Order" files; it gives some valuable suggestions to aid the purchaser in ordering files. A list of dealers is included.

Truck Platforms. Standard Pressed Steel Co., Jenkintown, Pa. A four-page circular describing the "Hallowell" steel lift truck platforms. The construction of the platform is illustrated in detail.

Monitor Thermaload Starter. Monitor Controller Co., Baltimore, Md. An advance introduction to the company's Bulletin No. 101, describing the Monitor thermaload starter for single and polyphase motors.

Quigley Fuel Systems. The Hardinge Company, New York, N. Y. Bulletin No. 13 describing methods of preparing, transporting and burning fuel. The book contains a wealth of valuable information on this subject, as well as useful data on heat-treating and metallurgical operations.

Dirt and Dust. Midwest Steel and Supply Co., New York, N. Y. A six-page circuar describing the Midwest unit air filters.

Black & Decker Tools. Black & Decker Manufacturing Co., Baltimore, Md. A miniature catalog describing and illustrating the B & D electric drills, screwdrivers, wrenches, grinders, cleaning machines and valve grinders.

Sawing Machinery. Oliver Machinery Co., Grand Rapids, Mich. Bulletin No. 5 containing some interesting data for those who have to do with circular saws or sawing machinery. It is illustrated with many photographs of actual sawing operations.

Manley Portable Hoists. The Manley Manufacturing Co., York, Pa. Bulletin No. 78 describing a line of portable hoists for use in garages and repair shops.

Automatic Stokers. The Combustion Engineering Corporation, New York, N. Y. A folder describing the company's Type K automatic stoker for small plants. The company has also issued a booklet on the application of pulverized coal to locomotives. This is known as the "Lupalco" system and examples of its use and its success are given in the booklet.

Forthcoming Meetings

American Gear Manufacturers' Association: Sixth annual meeting, Buffalo, N. Y., April 20 to 22. Secretary, F. D. Hamlin, 4401 Germantown Ave., Philadelphia, Pa.

Southern Supply and Machinery Dealers Association: Annual meeting, Birmingham, Ala., April 24 to 26. (In conjunction with American Supply and Machinery Manufacturers Association.) Secretary, A. M. Smith, c/o Smith-Courtney Co., Richmond, Va.

National Machine Tool Builders' Association: Spring Convention, Hotel Traymore, Atlantic City, N. J., April 25, 26 and 27. Ernest F. DuBrul, 817 Provident Bank Bldg., Cincinnati, Ohio, general manager.

National Research Council: Annual meeting of executive board, April 26, Washington, D. C. A. D. Flinn, 29 West 39th St., New York City, chairman.

Society of Industrial Engineers: Annual meeting April 26, 27 and 28, Detroit, Mich. G. C. Dent, 327 La Salle St., Chicago, Ill., business manager.

American Welding Society: Annual meeting, Engineering Societies Building, New York City, April 26 to 29.

National Association of Manufacturers: Annual meeting, Waldorf-Astoria Hotel, New York City, May 8, 9 and 10. Secretary, George Boudinot, 50 Church St., New York.

American Society of Mechanical Engineers: Spring meeting, Atlanta, Ga., May 8 to 12. Secretary Calvin W. Rice, 29 West 39th St., New York City.

National Supply and Machinery Dealers Association: Annual Convention, Atlantic City, May 8 to 10. (In conjunction with American Supply and Machinery Manufacturers Association.) Secretary, Thomas A. Fernley, 505 Arch St., Philadelphia, Pa.

Foreign Trade Council: Annual Convention, Philadelphia, Pa., May 10 to 12. Secretary, O. K. Davis, 1 Hanover Square, New York City.

United States Chamber of Commerce: Annual meeting, Washington, D. C., May 16 to 18. Secretary, D. A. Skinner, Riggs Bldg., Washington, D. C.

National Association of Office Managers: Annual meeting, Washington, D. C., May 18 to 20. Secretary, F. L. Rowland.

American Society for Steel Treating: Pittsburgh Section meeting, Bureau of Mines Auditorium, Pittsburgh, Pa., May 25 and 26.

American Foundrymen's Association: Annual meeting, Rochester, N. Y., week of June 5. Secretary, C. E. Hoyt, 140 South Dearborn St., Chicago, Ill.

American Railway Association: Section III, Mechanical: Annual meeting, Atlantic City, June 14 to 21. (Formerly the Master Car Builders and the Association of Master Mechanics.)

Society of Automotive Engineers: Summer meeting, White Sulphur Springs, W. Va., June 20 to 24. C. F. Scott, 29 West 39th St., New York City, is chairman of the convention committee.

American Society for Testing Materials: Twenty-fifth annual meeting, Chalfonte-Haddon Hall Hotel, Atlantic City, June 26 to July 1. Secretary, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

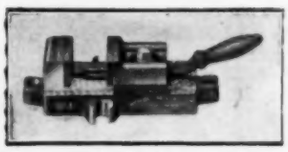
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Vise, Milling Machine, Quick-Acting

Athol Machine and Foundry Co., Athol, Mass.

"American Machinist," Jan. 5, 1922

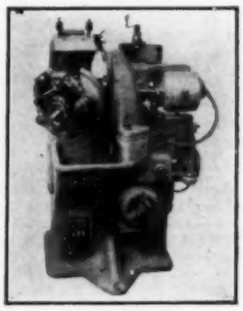


The vise is adaptable to use on drilling and milling machines. The movable jaw is operated by a lever and has a range of from $\frac{1}{8}$ to 5 in. The jaws are 3 in. wide, and consist of hardened steel plates held in place by screws. Special jaws can be furnished to suit the work, for more rapid clamping. The cast iron bed is 10 in. long, 6 in. wide, and $2\frac{3}{8}$ in. high. Four lugs are provided for clamping the vise to the table of the machine, and keyways are cut in the base. The cast-steel clamping lever acts on a $\frac{3}{4}$-in. steel bolt. Weight complete, $10\frac{1}{4}$ lb.

Gear Generator, Spiral Bevel, 4-In.

Gleason Works, Rochester, N. Y.

"American Machinist," Jan. 5, 1922

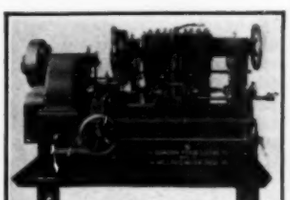


The machine is intended for manufacturing small gears in large quantities and for finishing the teeth from the solid. The feed motion is given to the cutter spindle carrier only. One motor drives the cutter and the other the feed and roll. Indexing is automatic and is actuated from the roll motion. The machine can also be used with a reduced roll to rough out gears of larger pitches. The cutters range in diameter from $1\frac{1}{16}$ to $3\frac{1}{2}$ in. The small cuters are solid with four blades, two cutting outside and two inside. The larger cutters have eight adjustable blades, four cutting inside and four outside. Floor space, 33 x 46 in. Weight, 2,000 pounds.

Lathe, Turning, Crankcheek, Gordon

Willard Machine Tool Co., Cincinnati, Ohio

"American Machinist," Jan. 5, 1922

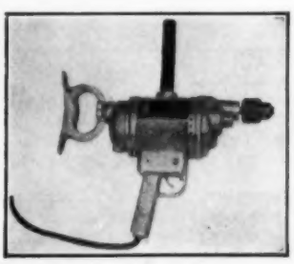


The machine is used to turn all the crankcheeks of a six-cylinder crankshaft simultaneously. The circular cutting tools are held in toolblocks which rotate in rocker arms. The work is fed past the cutting tools by a screw. A range of feeds is provided through the gear train. The machine is controlled by two horizontal levers at the ends of the shaft. The feed is engaged by the vertical lever, and disengaged by an automatic trip. Drive is through a friction clutch and two intermediate gears to the main intermediate shaft. The 3-in. circular cutter is mounted on a $\frac{3}{4}$-in. stud, and adjusted by means of a worm locked in the toolblock which meshes with hobbed teeth in the cutter.

Drill, Electric, Portable, Special, $\frac{1}{4}$ In.

Black & Decker Manufacturing Co., Baltimore, Md.

"American Machinist," Jan. 5, 1922

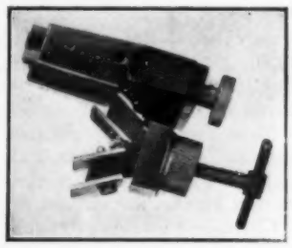


The drill has a capacity of $\frac{1}{4}$ in., possesses a pistol grip, a trigger switch and a universal motor for either direct or alternating current. It is supplied for 110-volt current, but can be furnished for 220 or 32 volts. A cooling fan is keyed to the armature shaft. The chrome-nickel-steel reduction gears are of stub-tooth form, and run in grease. A three-jaw geared nut chuck, capable of holding straight-shank drills up to $\frac{1}{4}$ in. in diameter, is furnished. The drill is provided with 15 ft. of electric cable, attachment plug, combination spade handle and breast plate, and detachable side handle. Weight 15 pounds.

Wheel-Truing Head, Permanent-Alignment

Precision and Thread Grinder Manufacturing Co., 1 South 21st St., Philadelphia, Pa.

"American Machinist," Jan. 5, 1922



The head can be used on all "Precision" thread grinding machines by attaching it to an extended cap for the front bearing. It can be inclined to the helix angle of the thread. A stop, provided for positioning the main slide, can predetermine the amount of flat left on the face of the wheel for grinding U.S.S. threads. The diamonds are simultaneously traversed by turning the T-handle, but as one diamond is set in advance of the other they do not cut at the same time. The diamond holders are set at an angle of 10 deg. to the planes of the slides.

Buffing Machine, Motor-Driven, Electric, A.C.

J. G. Blount Co., Everett, Mass.

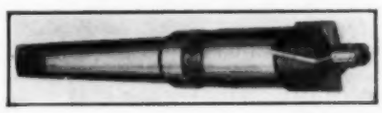
"American Machinist," Jan. 5, 1922

The machine is built in four sizes, $\frac{1}{2}$ hp. for wheels 6 x $\frac{1}{2}$ in., 1 hp. for wheels 8 x 1 in., 2 hp. for wheels 10 x $1\frac{1}{2}$ in., and 3 hp. for wheels 12 x 2 in. The head or motor unit is mounted with a pan on a column, but may be supplied on a bench base. A tool tray is bolted to the column, and a safety switch having a thermal cutout is mounted on the column beneath the tool tray. The machine is supplied for the following currents: The $\frac{1}{2}$-hp. motor for 110 or 220-volt, 60-cycle, single-phase current, and the 1, 2 and 3-hp. motors for 220, 440 or 550-volt, 60-cycle two or three-phase current.

Facing Tool, Spot, Junior

Eclipse Interchangeable Counterbore Co., 1618 St. Aubin Ave., Detroit, Mich.

"American Machinist," Jan. 5, 1922



The tool comprises a nickel-steel shank and holder, an externally and internally threaded pilot-nut screwed into the holder, a high-speed steel facing cutter and a machine-steel pilot. The cutter is positively driven by flats on the shank engaging with a slot in the holder. The pilot nut is screwed into the holder and the threaded end of the pilot is screwed into the nut, thus binding the cutter in place. Holders are made with Morse tapers Nos. 2, 3 and 4 for facing cutters from $\frac{1}{2}$ to $1\frac{1}{2}$ in., $1\frac{1}{2}$ to $1\frac{3}{4}$ in., and $1\frac{3}{4}$ to 3 in., respectively.

Grinding Machine, Hob-Sharpening, Automatic

Barber-Colman Co., Rockford, Ill.

"American Machinist," Jan. 5, 1922

The machine was designed primarily for sharpening hobs up to 4 in. in diameter and 4 in. in length, but can also be used for sharpening formed cutters. The work-arbor spindle, provided with a No. 8 B.&S. taper hole, runs in ball bearings. Indexing is positive and automatic. The rotary motion for helical work is imparted by an adjustable swiveled guide. The work is fed to the grinding wheel at the completion of each revolution of the hob, the motion being controlled by a thumbscrew regulator. The feed can be stopped automatically after grinding any predetermined amount. The machine is regularly belt driven and a countershaft is furnished. Floor space, 42 x 50 in. Height, 72 in. Weight 2,250 pounds.

Clip, paste on 3 x 5-in. cards and file as desired

The Weekly Price Guide

THIS WEEK'S MARKET

Advances—Steel sheets, blue annealed No. 10, $2.25@$2.40, Pittsburgh, as against $2.25; black No. 28 at $3@$3.15 instead of $3, and galvanized No. 28 at $4@$4.15 compared with $4 per 100 lb. last week.

New York quotes advance of 25c. on black sheets No. 28 and 35c. per 100 lb. on galvanized. Electrolytic copper up ¼c.; tin 1c.; lead and antimony ¼c. per lb. Raw linseed oil quoted at 84c. as against 82c.@83c. per gal. in 5 bbl. lots.

Cleveland quotes advances of ¼c. on old lead and zinc; ½c. on No. 1 yellow brass turnings.

Declines—Coke plates, bright, down 1c.; old copper ½c. and light brass ¼c. per lb. in Cleveland warehouses.

Market Firmer—Structural steel quoted at a minimum of $1.50 per 100 lb., Pittsburgh; steel prices tending upward, especially in semi-finished material. Bolts, nuts, rivets and other shop supplies considerably firmer in tone; cutting under the regular price quotations having entirely disappeared. Market firmer in sheet bars, pipe, tin plates, steel wire products, strip steel, zinc and linseed oil.

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$21.00
Northern Basic	21.02
Southern Ohio No. 2	21.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	26.87
BIRMINGHAM	
No. 2 Foundry	16.50
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25-2.75 sil	22.26
Virginia No. 2	28.74
Basic	20.25
Grey Forge	21.00
CHICAGO	
No. 2 Foundry local	20.70
No. 2 Foundry, Southern, sil 2.25@2.75	22.67
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	21.46
Basic	20.46
Bessemer	21.46

IRON MACHINERY CASTINGS—In cents per pound:

	Light	Medium	Heavy
Pittsburgh	11.0	7.0	4.0
Philadelphia	8.0	5.0	2.65
Atlanta	5.5	4.5	4.0
Detroit	7.0	4.5	3.0
Birmingham	12.0	6.5	3.0
Denver	8.0	6.0	5.0
New Orleans	6.0	4.5	3.5
Minneapolis	9.0	6.0	4.5
New York	9.0	6.0	3.0
Cincinnati	6.0	5.0	4.5
Cleveland	6.75	4.5	2.6

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.25@2.40	3.28	3.10	3.38
No. 12	2.30@2.45	3.33	3.15	3.43
No. 14	2.35@2.50	3.38	3.20	3.48
No. 16	2.55@2.70	3.48	3.30	3.58
Black				
Nos. 17 and 21.	2.85@3.00	4.05	3.55	3.95
Nos. 22 and 24.	2.90@3.05	4.10	3.60	4.00
Nos. 25 and 26.	2.95@3.10	4.15	3.65	4.05
No. 28	3.00@3.15	4.25	3.75	4.15
Galvanized steel sheets:				
Nos. 10 and 11.	3.00@3.15	4.25	3.75	4.15
Nos. 12 and 14.	3.10@3.25	4.35	3.85	4.25
Nos. 17 and 21.	3.40@3.55	4.65	4.15	4.55
Nos. 22 and 24.	3.55@3.70	4.80	4.30	4.70
No. 26	3.70@3.85	4.95	4.55	4.85
No. 28	4.00@4.15	5.25	4.75	5.15

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	BUTT WELD Inches	Iron Black	Galv.
1 to 3	71	58½	⅜ to 1½	44½	29½
LAP WELD					
2	64	51½	2	39½	25½
2½ to 6	68	55½	2½ to 4	42½	29½
7 to 8	65	51½	4½ to 6	42½	29½
9 to 12	64	50½	7 to 12	40½	27½
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	69	57½	⅜ to 1½	44½	30½
2 to 3	70	58½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	62	50½	2	40½	27½
2½ to 4	66	54½	2½ to 4	43½	31½
4½ to 6	65	53½	4½ to 6	42½	30½
7 to 8	61	47½	7 to 8	35½	23½
9 to 12	55	41½	9 to 12	30½	18½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	66%	53%	60½%	47½%	62½%	48½%
2½ to 6 in. steel lap welded	61%	47%	58½%	44½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 10%. Cast iron, standard sizes, 32–5% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.00	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	7.00	8.00	6.03
Hoop steel	3.38	2.56	3.13
Cold rolled strip steel	6.25	8.25	6.50
Floor plates	4.60	4.56	4.98
Cold finished shafting or screw	3.35	3.00	3.15
Cold finished flats, squares	3.85	3.50	3.65
Structural shapes (base)	2.48	2.31	2.38
Soft steel bars (base)	2.38	2.21	2.28
Soft steel bar shapes (base)	2.38	2.21	2.28
Soft steel bands (base)	2.98	....	2.88
Tank plates (base)	2.48	2.31	2.38
Bar iron (2.00@2.10 at mill)	2.38	2.21	2.28
Drill rod (from list)	55@60%	55%	50%
Electric welding wire:			
⅜	8.00		12@13
¼	6.50		11@12
5/32 to ¼	6.25		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	13.62½
Tin, 5-ton lots, New York	31.00
Lead (up to carlots), St. Louis, 5.15; New York	5.50
Zinc (up to carlots), St. Louis, 5.27½; New York	5.62½

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	19.20	20.00	18.00
Antimony (Chinese), ton spot	5.25	6.50	6.25
Copper sheets, base	19.50@20.50	20.50@21	23.00
Copper wire (carlots)	14@14.25	17.00	16.25
Copper rods (ton lots)	19.25	21.50	19.50
Copper tubing (100-lb. lots)	20.75	22.50	23.00
Brass sheets (100-lb. lots)	16.25	16.50	18.75
Brass tubing (100-lb. lots)	18.00	18.50	20.50

—Shop Materials and Supplies

METALS—Continued

Brass rods (1,000-lb. lots)	14.25	16.00	15.75
Brass wire (carlots)	16.75	17.75	.....
Zinc sheets (casks), (8% dis. carlots)	9.50	17.25	15.75
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	39.00	.....	.....
Solder (½ and ½), (caselots)	18.00	22.00	19.00
Babbitt metal (best grade)	30.80	39.50	36.00
Babbitt metal (commercial)	15.50	13.50	9.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N. J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	10.00	10.50	10.25
Copper, heavy, and wire	9.50	9.50	9.25
Copper, light, and bottoms	8.50	8.50	8.25
Lead, heavy	3.75	3.75	3.65
Lead, tea	2.75	2.75	3.00
Brass, heavy	5.75	5.50	8.00
Brass, light	4.25	4.00	4.75
No. 1 yellow brass turnings	5.00	5.50	5.00
Zinc	2.75	2.25	2.50

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

		New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:				
IC,	20x28, 112 sheets	20.00	18.25	18.50
IX,	20x28, 112 sheets	23.00	21.00	20.90
"A" Charcoal Allaways Grade:				
IC,	20x28, 112 sheets	17.00	16.00	17.00
IX,	20x28, 112 sheets	20.00	18.75	19.60
Coke Plates, Bright				
Prime, 20x28 in.:				
100-lb.,	112 sheets	12.50	11.00	14.50
IC,	112 sheets	12.80	11.40	14.80
Terne Plate				
Small lots, 8-lb. Coating:				
100-lb.,	14x20	7.00	5.60	7.25
IC,	14x20	7.25	5.85	7.40

MISCELLANEOUS

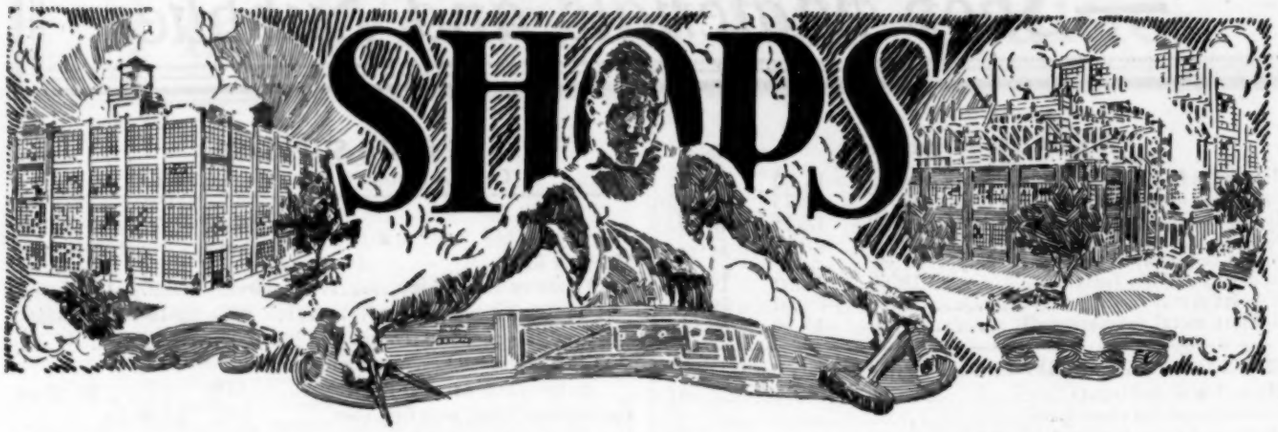
	New York	Cleveland	Chicago
Cotton waste, white, per lb	$0.07½@$0.10	$0.12	$0.12
Cotton waste, mixed, per lb	.055@.09	.09	.09
Wiping cloths per M., 13½x13½	.....	50.00	55.00
Wiping cloths per M., 13½x20½	.....	55.00	65.00
Sal soda, 100 lb. lots	2.80	2.50	2.65
Roll sulphur, 360 lb. bbl., per 100 lb	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	.84	1.06	.90
White lead, dry or in oil	100 lb. kegs.	New York, 12.25	
Red lead, dry	100 lb. kegs.	New York, 12.25	
Red lead, in oil	100 lb. kegs.	New York, 13.75	
Fire clay, per 75 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville	per net ton	$3.25@$3.50	
Coke, prompt foundry, Connellsville	per net ton	$4.25@$4.75	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	60-5%	60-10%	60-10-10%
1¼ and 1½x3 in. up to 12 in.	50%	60-10-10%	60-10%
With cold punched sq. nuts	50%	.....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	55%	.....	$4.00 off
Button head bolts, with hex. nuts	35%	$3.90 net	.....
Hex. head and hex. nut bolts	40%	.....	65-5%
Lag screws, coach screws	65%	.....	65-5%
Square and hex. head cap screws	75—10%	75%	70-10%
Carriage bolts, up to 1 in. x 30 in.	50-10%	60-10%	50-5%
Bolt ends, with hot pressed nuts	60%	.....	55%
Tap bolts, hex. heads	25%	.....	.....
Semi-finished nuts ⅝ and larger	75%	75-10%	80%
Case-hardened nuts	65%	.....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$4.50	$3.50	$3.50
Washers, cast iron, ⅜ in. per 100 lb. (net)	3.75	3.50	3.50
Washers, round plate, per 100 lb. Off list	4.00	....	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	3.00	3.50	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	3.00	3.50	4.00
Nuts, cold punched, sq., per 100 lb. Off list	3.00	3.50	4.00
Nuts, cold punched, hex., per 100 lb. Off list	3.00	3.50	4.00
Rivets:			
Rivets, $\frac{7}{16}$ in. dia. and smaller	60-5%	60-10-10%	65-5%
Rivets, tinned	60-5%	60-10-10%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net)	$3.35	$3.25	$3.00
Cone heads, ditto (net)	3.45	3.35	3.10
1¼ to 1¾-in. long, all diameters, *EXTRA* per 100 lb	0.25	.....	0.15
⅝ in. diameter *EXTRA*	0.15	.....	0.15
½ in. diameter *EXTRA*	0.50	.....	0.50
1 in. long, and shorter *EXTRA*	0.50	.....	0.50
Longer than 5 in. *EXTRA*	0.25	.....	0.25
Less than 200 lb. *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.35	.....	$3.35 base
Copper rivets	60-5%	50%	50-10%
Copper burs	40%	50%	.....
Lard cutting oil (50 gal. bbl.) per gal.	$0.65	$0.50	$0.67½
Machine oil, lubricating, (50 gal. bbl.) per gal.	0.45	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls)			
Leather:			
Light grade	50%	50-5%	60-10%
Medium grade	40-5%	40-10-2½%	50%
Heavy grade	35%	40%	40-5%
Rubber and duck:			
First grade	60-5%	50-10%	40-10%
Second grade	60-10-5%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets, Flint paper	$5.84	$3.85	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	32.75	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll	4.50	.....	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	1.32	.....	1.49
Cloth	3.02	....	3.20

NEW and ENLARGED



Machine Tools and Machinery Wanted

Machinery wants published without charge

Machine Tools

Ind., Alexandria——The Zeigler Mfg. Co., manufacturers of metal stampings, etc.—
Ont small straightening roll.
Two squaring shears, 72 in. to 120 in. long.
One No. 6 inclinable geared Bliss press.
One small japanning and enameling outfit.
One spot welder.
One rotary slitting shear, geared.
One large arch screw press for die tryout in toolroom, No. 3 Bliss preferred.
One Universal grinder, 12 in. x 36 in.
One pendulum foot press.
Circle shear No. 14.
Three thread rollers for sheet metal.
Four study threaders.
Four nut tappers.
Two rotary annealing furnaces.
Four rotary washers.
One plain grinder, 6 in. x 32 in.
Five drill presses.
Five small tapping machines.
Two production hardening and heat treating furnaces.
One continuous production rotary millers.

Ind., Evansville—The Faultless Caster Co., Stringtown Rd.—single stroke header.

Ky., Louisville—The Louisville Machine Co., 308 East Main St.—turret lathes and one 24 in. drill press.

Mass., Chelsea—R. T. Green Co., 210 Marginal St.—heavy bending rolls and air compressor of about 500 cu.ft. capacity.

Mass., Worcester—The Matthews Mfg. Co., 104 Gold St.—surface grinder.

Mich., Ann Arbor—The Bd. Regents, University of Michigan—equipment for engineering shops.

Mich., Detroit—Schiffman & Co., 327 East Fort St.—wood turning lathe.

Mo., Joplin—G. S. Davis Studio, 1044 Main St.—drill press and lathe for power machine shop.

Mo., Joplin—The Economy Furniture Co., 916 Main St., W. B. Hunt, Purch. Agt.—power wood lathe.

Mo., Joplin—The Casper County Electric Supply Co., 1412½ Main St., A. Steincoft, Purch. Agt.—air compressor and lathe for power.

Mo., Joplin—J. Doke, 308 East 7th St.—power drill press.

Mo., Joplin—Parmer Bros., 7th and Virginia Aves., C. R. Parmer, Purch. Agt.—power drill press and power lathe for garage machine shop.

Mo., Webb City—J. A. Sorg, North Hall and Daugherty Sts.—power lathe.

Mo., Webb City—The Wilhite Auto Painting & Top Co. North Hall St. and Bway., J. F. Wilhite, Purch. Agt.—drill press, lathe and grinder for power.

Neb., Lincoln—The Pearl Furnace Co., 1023 O St., (sheet metal workers)—J. B. Van Velkinburgh, Purch. Agt.—42 in. pipe mandrel and 30 in. square shears.

N. Y., Buffalo—McKaig-Hatch Co., Skillen St. along the tracks of the New York Central R.R.—drop hammers, machinery and equipment for forge shop.

N. Y., Elmira—The Highway Products & Mfg. Co., 735 Baldwin St.—sheet metal working tools and equipment for the manufacture of corrugated iron culverts, 12 in.-48 in. diameter.

N. Y., Hicksville — Karlson-Lee — Star drilling machine.

N. Y., Lancaster—The Bd. Educ., F. A. Schaefer, Purch. Agt.—wood and metal working tools for manual training classes in high school.

N. Y., Mayville—F. M. Waite—small tools and machinery for garage now under construction.

N. Y., New York—C. R. Bates Co., Inc., 21 Howard St., manufacturer of railroad and shipbuilders supplies—metal cutting tools and drills.

N. Y., North Tonawanda—White & Haskell Co., Main St.—one 14 in. lathe; small drill press; air compressor and tank, for machinery and repair shop.

N. Y., Ogdensburg—The Ogdensburg Water Wks. Dept., D. J. Crichton, Purch. Agt.—power driven pipe threading and tapping machine.

N. Y., Rochester—B. G. Costich, 251 Hayward Ave.—tools, machinery and equipment for repairing gas motors.

N. Y., Rochester—H. Lipshitz, 461 Joseph Ave.—one 16 in. jointer, 16 in. rip saw, wood turning lathe, bore machine and spindle.

N. Y., Watertown—H. Derouin Co., 137 Charles St.—sheet metal working machinery and equipment.

O., Alliance—The Safety Ice Pick Co., 808 East Cambridge St., G. Trumpeter, Genl. Mgr.—general machinery for ice pick factory.

O., Youngstown—The Youngstown Sheet & Tube Co., East Youngstown St., Address Purch. Dept.—machinery for the manufacture of steel plates.

Pa., Pittsburgh—The American Mine Equipment Co., W. D. Stockly, Purch. Agt.—two punch presses, equivalent to the Niagara No. 37 plain press, 2 in. stroke, 3 in. hole for punch shank.

Pa., Pittsburgh—The Edgewater Steel Co., Edgewater Sta., W. A. McKean, Purch. Agt.—one Ridgway type hub facing machine for car wheels, motor driven.

S. C., Lena—H. L. Lawton—one hundred eleven ft. of shafting, 8 4 7/16 in. collars, 3 bevel gears 24 in. diameter 4 7/8 in. teeth, 5 flange couplings, 16 pillow boxes.

Vt., Burke—Wiggins Machine & Mfg. Co., Inc., A. V. Wiggins, Pres.—turners and turret equipment for 3 x 36 Jones & Lamson and No. 4 Warner & Swasey turret lathes, (used).

Va., Norfolk—J. B. Porter, P. O. Box 255—tinners squaring shears to cut up to 20 gauge, also tinners cornice brake, (used).

Wis., Manitowoc — The Hamacheck-Bleser Co., 11th and Franklin Sts.—presses and repair equipment for proposed garage and repair shop.

Machinery

Ala., Sheffield—K. Sparks—dredging machinery to dig sand and gravel and deliver same on barges, including chain, bucket, dredge with 5 to 7 cu.ft. bucket and about 60 ft. ladder.

Conn., Ansonia—The Jayne Garage, 163 Wakelee Ave.—one ton chain hoist.

Conn., Bridgeport—R. H. Gorham, R. F. D. 3—one ton chain hoist for farm.

Ia., Des Moines—The Bd. Educ., G. L. Garton, Secy.—manual training shops and machinery for Theodore Roosevelt High School.

Ill., Pontiac—The Allen Candy Co.—ice machinery for proposed ice plant.

Ind., East Chicago—The Green Eng. Co., Kennedy St.—belt driven air compressor of 300-450 cu.ft. capacity to operate on 80-100 lb. pressure, (used).

Kan., Pittsburg—The Pittsburg Candy Co., 1211 North Bway.—machinery for making candy.

Ky., Sturgis—W. Herbert—complete line of coal mining machinery, including hoists, conveyors, washing machinery, mine and power plant equipment.

Mass., Fall River—Fyans, Fraser & Blackway Co., 83 Anawan St.—dyeing machine for cotton goods, (continuous).

Me., East Wilton (Wilton P. O.)—Gledhill Woolen Co.—2 jack winder machines.

Mich., Detroit—A. W. Fellers, 6035 14th Ave.—woodworking equipment including matcher and finishing machine.

Mich., St. Clair—The Diamond Crystal Salt Co., F. Moore, Mgr.—equipment for proposed plant at Courtright, to have capacity of 700 bbl. daily.

Mo., Joplin—The Joplin Marble Wks., 1047 Main St., W. D. Northern, Purch. Agt.—automatic drilling machinery and power hammers.

Mo., Joplin—The Monarch Garage, 410 Penna Ave., R. A. Nicely, Purch. Agt.—leather working machinery for automobile upholstery department.

Mo., Joplin—Walkers Planing Mill, 1305 Joplin St., H. H. Walker, Purch. Agt.—woodworking machinery for the manufacture of wooden boxes.

Mo., Joplin—The Ward Optical Co., 530 Main St., W. E. Ward, Purch. Agt.—power optical grinder.

Mo., Springfield—The Saint Louis—San Francisco R. R., B. T. Wood, Vice-Pres. and Ch. Purch. Officer—$200,000 worth of machinery for repair shops here.

Mo., St. Louis—L. Litch, 2927 South 13th St.—printing press.

Mo., St. Louis—D. O. O'Leary, 2600 Bellegrade St.—woodworking machinery.

Mo., St. Louis—G. Stein, 1229½ Chauteau St.—printing press.

Mo., Webb City—Denny-Maier Upholstering Co., 210 North Main St.—planer, wood lathe for furniture repairing also woodworking machinery.

Neb., Lincoln—The Lincoln Storage Battery Co., 1425 N St., R. C. Fields, Mgr.—grid moulds for 5⅝ in. x 4⅝ in. x ⅛ in. and for 5⅝ in. x 4⅛ in. x ⅛ in. battery grids, both for straight lug grids.

Neb., Lincoln—The Port Huron Mchy. Co., 817 R St., tractor supply house, W. J. Edwards, Purch. Agt.—power hack saw and 2 hp. electric motor, (used).

Neb., Lincoln—The Ziegler Battery Co., 1609 N St., G. Ziegler, Purch. Agt.—will install electrical department for repair of automobile generators and starting motors, and is in the market for repair parts and replacement material.

N. Y., Avon—The Avon Knitting Co., Inc., C. T. Davis, Secy.—machinery for the manufacture of knit goods.

N. Y., Binghamton—J. H. Carver Co., Inc., 72 State St., J. H. Carver, Purch. Agt.—flat four wheel industrial trucks and one large size paper baler.

N. Y., Brooklyn—The Natl. Fdry. Co., 10 Sandford St.—electric arc welding outfit with 7½ hp., d.c. motor and generator.

N. Y., Buffalo—The Richardson & Boynton Co., Kensington Ave.—foundry machinery and equipment.

N. Y., Dexter—The Dexter Sulphite Pulp & Paper Co., C. Campbell, Purch. Agt.—paper cutting and slitting machinery.

N. Y., Friendship—F. J. Moser—compressor, small 2 stage, capacity 25 to 50 ft. per min., pressure 250 lbs.

N. Y., Geneva—W. L. Packard, 780 South Main St.—one No. 5 magazine for printing job work office.

N. Y., Hammand—The J. R. Scanlon Co., Main and Depot Sts., J. R. Scanlon, Purch. Agt.—one portable forge and blower; battery charging outfit and panel.

N. Y., Harrisville—The Diana Paper Co.—paper cutting and slitting machinery.

N. Y., Long Island City—The Cornellist Textile Corp., 45 Jamaica Ave.—tentering machine, (used).

N. Y., New York—The Gloria Knitting Mills, Inc., 27 East 21st St.—several 8 in. Brinton knit machines and ribbing machines.

N. Y., New York—The Hammond Typewriter Co., 537 East 69th St.—locomotive crane, 40-50 ft. boom, with electric or gasoline hoist.

N. Y., New York—The International Paper Co., 30 Broad St.—paper cutting and slitting machinery.

N. Y., New York—Neemes Bros., Inc., 206-18 1st St., R. R. Rees, Purch. Agt.—air chippers for chipping cast iron castings; 3 or 5 ton jib crane; cupalo bottom for 60 in. shell; air compressor of about 175 cu.ft.

N. Y., Norfolk—The Hanna Paper Corp., W. Simons, Purch. Agt.—paper cutting and slitting machinery.

N. Y., Port Gibson—H. R. Ericson—small or medium sized printing press.

N. Y., Potsdam—The Racquette River Paper Co., R. E. Sisson, Purch. Agt.—paper cutting and slitting machinery for kraft paper.

N. Y., Rochester—A. W. Hopeman & Sons Co., Lyell Ave.—machinery for furniture plant now in course of construction.

N. Y., Silver Creek—J. U. Hammond—machinery for bottling beverages and roasting coffee, for proposed factory in Jamestown.

N. Y., Utica—The Boonville Sand Corp., H. V. Owens, Purch. Agt.—sand and gravel conveying, screening and grading equipment.

N. C., Burlington—T. J. Horner—machinery and outfit for the manufacture of mattresses, (used).

N. C., Mebane—Crawford & Crawford, J. Crawford, Purch. Agt.—wood veneering machinery, (new or used).

N. C., Salisbury—J. T. Wyatt, Box 10, manuafcturer of paint—paint grinding mill, (used).

O., Cleveland—The Cleveland Graphite Bronze Co., 2906 Chester Ave.—one 6 x 6 air compressor.

O., Youngstown—The Lake Erie Limestone Co., 906 Wick Bldg.—one conveyor about 130 ft. long, 30 in. belt, and one rotary screen.

Pa., Franklin—G. E. Glines and F. A. Howard—$10,000 worth of refrigeration machinery for proposed milk plant on 10th St.

Pa., Norristown—The Amer. Asbestos Co., Strgr. and Stnbrdg.—heavy belting looms for making solid woven belting from 3-10 in. and about ⅜-⅝ in. thickness.

Pa., Phila.—The Chesterman Leeland Co., 902 Montgomery St.—small finishing machine for elastic webbing making.

Pa., Phila.—Wertz & Volk, c/o D. D. Wertz, Archt., Real Estate Trust Bldg.—steam kettles, conveyors, etc., for slaughter house.

Pa., Pittsburgh—The Amer. Sheet & Tin Plate Co., Frick Bldg., M. S. Dennis, Purch. Agt.—jib crane and traveling crane.

Pa., Pittsburgh — The Pittsburgh Des Moines Steel Co.—10 ton, 3 motor crane, 23 ft. 9 in. span.

S. C., Greenwood—M. C. Marshall—complete line of canning machinery and equipment for canning fruits and vegetables.

Va., Norfolk—E. B. Murchant, Genl. Delivery—combination woodworking machinery, (used).

Va., Roanoke—G. Dinguid, 824 13th St.—complete line of machinery for the manufacture of brooms.

Va., Waverly—The Natl. Peanuts Product Co., C. E. Reick, Mgr.—peanut butter mill and miscellaneous candy manufacturing machinery, (new or used).

Va., Winchester—The Winchester Lumber Corp., W. B. Cornwell, Genl. Mgr.—machinery for the manufacture of hard wood flooring, (used).

Wis., Blair—The Blair Canning Co., A. J. Boe, Purch. Agt.—hullers, viners, sorters, operated by line shaft, for vegetable canning plant.

Wis., Eden—The Empire Dairy Co., c/o B. McCrory, Route 1—creamery machinery including separators, churns and testers.

Wis., Holmen—The Holmen Creamery Assn., V. Keppel, Mgr.—modern butter making machinery, shafting, belting, etc., for proposed creamery.

Wis., Milwaukee—The Ideal Dairy Co., c/o G. R. Welland, 415 32nd Ave.—dairy products machinery, separators, churns and print machines, steam power driven.

Wis., Milwaukee—J. Merkowski, 926 16th Ave.—portable saw mill to saw logs about 18 in. in diameter.

Wis., Milwaukee—The Monarch Mfg. Co., 70 Chicago St., manufacturers of overalls, clothing, etc., S. Brochman, Purch. Agt.—power stitching and stamping machines.

Wis., Milwaukee—R. Tubesing, 852 6th St.—gas storage tank and pump.

Wis., New London—Hamilton & Sons Co., E. Hamilton, Pres.—canning machinery and conveying machinery for proposed cannery.

Wis., Stevens Point—The Pfiffer Lumber Co., 229 Franklin St.—electric motors, woodworking machinery, planers, lathes, etc.

Ont., Dundas—The Thornton Blanket & Woolen Co., R. R. No. 1.—woolen weaving and picking machinery.

Ont., Galt—The Riverside Silk Mills, River St.—special machinery and equipment for the manufacture of silk.

Ont., Guelph—The Dominion Linens, Ltd., D. M. Sanson, Pres.—additional machinery and equipment. Estimated cost, $40,000.

Ont., London—The Pure Gasoline Co., 362 Dundas St., J. Factor, Mgr.—gasoline and lubrication equipment for proposed gasoline stations.

Ont., London—T. Terry, 150 Fullerton St.—machine shop equipment.

Ont., Port Stanley—The London Port Stanley Ry., London—$35,000 worth of electrically operated dmachinery including, buckets, derrick and operated machinery for coal handling depot.

Ont., St. Mary's—The Hurlbut Shoe Co., C. E. Hurlbut, Mgr.—special shoe machinery and equipmemnt. Estimated cost, $30,000.

Ont., Toronto—The Orange Crush Bottlers, Ltd., 100 Claremont St.—equipment for branch bottling plants at London and Windsor. Estimated cost, $30,000.

Metal Working Shops

Cal., Oakland—C. A. Hancock, c/o H. J. Christensen, Federal Bldg., has awarded the contract for the construction of a 1 story garage on 23rd and Valdez Sts. Estimated cost, $40,000.

Cal., Oakland—The Universal Products Co., Thayer Bldg., has had sketches made for the construction of a factory for the manufacture of household products. Estimated cost, $100,000. F. H. Horswill, Thayer Bldg., Archt.

Cal., San Francisco—D. A. Reidy, Archt., Pacific Bldg., is receiving bids for the construction of a 1 story factory on Bryant and Sterling Sts., for the Magnolia Metal Co., Pacific Bldg. Estimated cost, $12,000.

Cal., San Francisco—The United Garage Co., c/o O'Brien Bros., Inc., Archts., 240 Montgomery St., is having plans prepared for the construction of a 5 story commercial garage on Ellis St. near Mason St. Estimated cost $165,000.

Cal., San Jose—N. Kooser, 446 South 2nd St., has awarded the contract for the construction of a 2 story garage on River and Santa Clara Sts. Estimated cost, $40,000. Hayes & Canelo, lessees.

Conn., Stamford—The Victor-Page Motor Corp., Farmingdale, N. Y., has awarded the contract for the construction of a 1 story, 60 x 200 ft. factory, (1st unit) on Melrose Ave., here. Estimated cost, $40,000.

D. C., Wash.—W. W. Biggs, 1310 14th St., N.W., has awarded the contract for the construction of a garage. Estimated cost, $85,000.

Ill., Dixon—E. R. Watts has awarded the contract for the construction of a 1 story, 54 x 150 ft. garage. Estimated cost, $40,000. Noted March 30.

Ill., Joliet—The Reo Joliet Sales & Service Co., 121 South Bluff St., will soon award the contract for the construction of a 1 story, 50 x 124 ft. garage. Estimated cost, $42,000. Private plans.

Mass., Charlestown—D. J. Kane, 73 Tremont St., Boston, has awarded the contract for the construction of a 2 story, 103 x 120 ft. garage on Warren St. Estimated cost, $60,000.

Mass., Springfield—The U. S. Spring Bed Co., 228 Birnie Ave., has awarded the contract for the construction of a 1 and 2 story, 70 x 100 ft. and 50 x 100 ft. addition to its plant. Estimated cost, $40,000.

Mich., Ann Arbor—The Bd. Regents, University of Michigan, will soon award the contract for the construction of a 4 story, 189 x 248 ft. engineering building, shops and laboratory, on East University Ave. Smith, Hinchman & Grylls, 710 Washington Arcade, Detroit, Engrs. Noted Dec. 15.

Mich., Detroit—M. Zack, 121 Josephine St., is having plans prepared for the construction of a 1 story, 22 x 60 x 86 ft. machine shop and garage on Holbrook St. Estimated cost, $20,000. J. Weinberg, 401 Congress Bldg., Archt.

Mo., Jefferson City — The Automatic Water Pump Mfg. Co., 236 East High St., will build six or seven 1 story factory buildings. Estimated cost, $100,000. Noted March 30.

Mo., St. Louis—The Johnson Automobile Co., 3667 Olive St., will soon award the contract for the construction of a 2 story, 50 x 52 ft. garage on Olive St. Estimated cost, $45,000. W. L. Johnson, Pres. W. P. McMahon, Title Guaranty Bldg., Archts. Noted March 30.

N. Y., Buffalo—E. R. Emig, 871 East Ferry St., plans to build a machine shop on East Ferry St. Estimated cost, $10,000. Architect not selected.

N. Y., Buffalo—The New York Central R.R., Grand Central Terminal, New York, plans to build a forge shop here. Estimated cost, $12,000. McKaig Hatch Co., 1584 Niagara St., Archts.

N. Y., Buffalo—The Stearns Electric Equipment Co., 66 Bway., plans to build an addition to its shop. Estimated cost, $12,000. Architect not announced.

N. Y., Falconer—C. J. Wilcox, Ashville, plans to build a 2 story, 50 x 130 ft. factory on East Main St., here. Estimated cost, $10,000. Architect not anncunced. Progressive Machine Co., lessee.

N. Y., New York—The Prudential Iron Co., 633 Concord Ave., plans to construct a plant and office building on 140th St. adjoining the New York, New Haven & Hartford R.R. tracks. Estimated cost, $150,000. Architect not selected.

O., Willoughby—L. Martin & Sons, Curtland, (Willoughby P. O.), are having plans prepared for the construction of a 1 story, 65 x 82 ft. garage here. Estimated cost, $40,000. Private plans.

Pa., Greenville—The DuRoth Steel Truck & Car Wheel Co. plans to build a factory on Osgood St., here. Architect not selected.

Pa., Phila.—W. L. Charr, Archt., 149 South 4th St., is receiving bids for the construction of a 1 story, 70 x 150 ft. garage on Frankford and Clementine Aves., for A. Salot, 3133 Frankford Ave. Estimated cost, $90,000.

Pa., Phila.—R. W. Pollock, Archt., 1802 Chestnut St., will receive bids until May 1 for the construction of a 2 story, 46 x 52 ft. sales and service station at 1155-57 South Broad St., for J. A. Cunningham. Estimated cost, $80,000.

Tex., Beaumont—The Brooks Supply Co., 799 Franklin St., plans to enlarge its machine shops.

Utah, Salt Lake City—The Utah Steel Corp., Boston Bldg., plans to build 1 story blast furnaces, near here. Estimated cost, $500,000. A. J. McKeen Co., 2422 Euclid Ave., Cleveland, O., Engrs.

Wis., Manitowoc—Hamacheck-Bleser Co., (owner), 11th and Franklin Sts., and Smith & Reynolds, archts., Dempsey Bldg., archts., will receive bids until April 29, for the construction of a 1 story, 50 x 139 ft. garage and repair shop. Estimated cost, $50,000.

Wis., Milwaukee—R. Tubesing, 852 6th St., has awarded the contract for the construction of a 2 story, 32 x 120 ft. garage on Fond du Lac Ave. Estimated cost, $40,000.

Ont., London—The Pure Gasoline Co., 362 Dundas St., will build and equip 15 modern gasoline stations. Estimated cost, $150,000. J. Factor, Mgr.

Ont., London—T. Terry, 150 Fullerton St., will soon award the contract for the construction of a 1 story, 50 x 200 ft. garage and machine shop. Estimated cost, $25,000. Private plans.

Ont., Ottawa—The Beach Motors, Ltd., 186 Albert St., will build a 2 story, 133 x 200 ft. garage on Bank St. Estimated cost, $100,000.

H. T., Pearl Harbor—The Bureau of Yards and Docks, Navy Dept., Wash., D. C., will receive bids until June 7 for the completion of a machine shop here.

General Manufacturing

Cal., Hayward—P. Verzic is having plans prepared for the construction of a 1 story bakery on Castro St. between A and B Sts. Estimated cost, $20,000. Sorenson Bros., 1110 C St., Archt.

Cal., San Francisco — The Gragnano Products Co., Inc., 823 Valencia St., is having plans prepared for the construction of a 2 story paste factory on 20th St. and Potrero Ave. Estimated cost, $20,000. A. J. Horstman, Anglo Bldg., 16th and Mission Sts., Archt.

Cal., San Francisco — The Natl. Ice Cream Co., 371 Guerrero St., has had plans prepared for the construction of a 2 story warehouse and packing plant on Guerrero St. near 16th St. Estimated cost, $26,000. W. Mooser, Nevada Bank Bldg., Archt.

Cal., San Francisco—The Southern Pacific Co., S. P. Bldg., and the Pacific Fruit Express Co., 65 Market St., are having plans prepared for the construction of an ice and loading plant on Bakersfield St. Estimated cost, $400,000. W. C. Phillips Co., 311 California St., Engrs.

Cal., San Luis Obispo—G. Jacobs has awarded the contract for the construction of a 2 story bakery. Estimated cost, $19,000.

Cal., San Rafael—The San Rafael Ice Co. plans to build a 50 x 100 ft. ice plant, to have capacity of 15 ton per day. Estimated cost, $50,000. E. P. Grady, Pres. Architect not selected.

Fla., Orlando—The Orlando Water & Light Co. plans to increase capacity of gas plant from 300,000 to 1,000,000 ft. per day. Estimated cost $75,000.

Ill., Chicago—A. S. Ahlschuler, Archt., 28 East Jackson Blvd., will soon receive bids for the construction of a 6 story, 170 x 177 ft. printing plant on Prairie Ave. and 20th St., for the Atwell Printing & Binding Co., Sherman and Polk Sts. Estimated cost, $700,000. Noted Jan. 12.

Ill., Chicago — The Paasche Air Brush Co. 1219 West Washington St., has awarded the contract for the construction of a 2 story, 150 x 150 ft. factory at 1909-15 Diversey Parkway. Estimated cost, $75,000. Noted March 30.

Ill., Clinton—The Puritan Products Co. plans to build a 2 story, 66 x 132 ft. dairy and creamery. Estimated cost, $50,000. Architect not selected.

Ill., East St. Louis—The Highland Ice Cream Co. will build a 1 story, 45 x 105 ft., 57 x 58 ft. and 26 x 30 ft. ice cream plant on St. Clair St. Estimated cost, $75,000.

Ill., Pontiac—The Allen Candy Co. plans to build a 1 story ice plant. Estimated cost, $25,000. Architect not selected.

Ind., Hammond—M. R. Carpenter, Archt., 105 North Clark St., Chicago, will soon receive bids for the construction of a 1 story, 90 x 151 ft. ice cream factory for the Consumers Ice Co., c/o architect. Estimated cost, $50,000.

Kan., Pittsburg—The Pittsburg Candy Co. plans to build a 2 story candy factory at 1211 North Bway. Estimated cost, $20,000.

Ky., Louisville—The Kentucky & Indiana Dairies Co., 500 Fehr Ave., plans to construct a creamery building on Fehr Ave. Estimated cost, $6,000. Architect not announced.

Mass., Clinton — The Bigelow Hartford Carpet Co., 58 Main St., Thompsonville, Conn., is having plans prepared for the construction of a 1 story dyehouse, etc. Private plans.

Mass., Lawrence—Walworth Bros. Inc., Merrimack St., has awarded the contract for the construction of a 3 story, 50 x 130 ft. addition to its textile mill. Estimated cost, $60,000.

Mass., North Dighton—The Mt. Hope Finishing Co. will soon award the contract for the construction of a 1 story, 115 x 200 ft. main building; 1 story, 50 x 150 ft. soap house; 1 story, 40 x 155 ft. dairy; 1 story, 50 x 150 ft. chemical laboratory and four 1 story steel storehouses. Private plans.

Mass., Southboro—The Dennison Mfg. Co., Framingham, has awarded the contract for the construction of a 4 story, 68 x 290 ft. plant, here, for the manufacture of tags, etc. Estimated cost, $400,000.

Mass., Springfield—The Bakery Finance Corp. (Grocers Bead Co., owner), Dexter Bldg., has awarded the contract for the construction of a 2 story bakery. Estimated cost, $150,000.

Mass., Springfield — The Springfield Blower Co., 89 Morris St., plans to build a 1 and 2 story plant (blower systems), on Ashley St. Architect not selected.

Mo., Hannibal—The Bluff City Shoe Co., c/o W. A. Meyer, Pres., has awarded the contract for the construction of a 2 story factory at 1201 Collier St. Estimated cost, $25,000. Noted March 2.

Mo., Jefferson City—The Strawboard Mfg. Co. is having plans prepared for the construction of a 2 story, 60 x 150 ft. strawboard factory. Estimated cost, $36,000. Private plans.

Mo., St. Louis—The American Syrup & Preserving Co., Ruskin Ave., will build a 2 story, 60 x 255 ft. warehouse and factory on Penrose Ave. Estimated cost, $25,000. Noted March 30.

Minn., St. Paul—The Daily News Publishing Co., 94 East 4th St., has awarded the contract for the construction of a 3 story, 100 x 150 ft. newspaper plant, etc., on 4th St. between Cedar and Minnesota Sts. Estimated cost, $100,000. Noted Feb. 16.

Mo., St. Louis—J. O. Chenoweth Dyeing & Cleaning Co., 1400 Washington St., will soon award the contract for the construction of a 2 story, 119 x 160 ft. dyeing and cleaning establishment on Delmar Blvd. and Bayard Ave. Estimated cost, $50,000. A. B. Groves, 314 North 4th St., Archt. Noted Dec. 15.

N. J., Camden—J. B. Van Scriver Co. has awarded the contract for the construction of a 7 story, 57 x 61 x 199 x 220 ft. factory on Federal St., for the manufacture of furniture. Estimated cost, $600,000. Noted Feb. 23.

N. J., Trenton—C. V. Hill & Co., 360 Pennington Ave., will build a 2 story, 48 x 190 ft. addition to its refrigerator works. Estimated cost, $25,000.

N. Y., Albany—The Oneida County Creameries Co., Inc., Paul Bldg., Utica, has awarded the contract for the construction of a milk plant on Tivoli St., here. Estimated cost, $40,000. Address S. J. Norton, 432 2nd Ave., Albany, Mgr.

N. Y., Batavia—The Gypsolite Co., Inc., has purchased a site on Harvester Ave., and plans to build a 1 story, 60 x 400 ft. factory. Estimated cost between $75,000 and $100,000. Address J. F. Haggerty, Pres., 66 Bedford Ave., Buffalo.

N. Y., Buffalo—E. T. Danahy, 602 Babcock St., plans to build a packing plant, office and garage on Babcock St. Estimated cost, $46,000.

N. Y., Little Falls—The Barnet Leather Co., 81 Fulton St., New York City, will soon award the contract for the construction of a factory here. Estimated cost, $100,000. Thomas & Binger, 280 Madison Ave., New York City, Archts and Engrs.

N. Y., Naples—The New York Pea Packers Inc., has awarded the contract for the construction of a cannery, including a 1 story, 40 x 110 ft. main building, a 1 story, 72 x 95 ft. vinery shift and a 1 story, 20 x 30 ft. office building.

N. Y., New York—The New York Tribune, Inc., 154 Nassau St., will soon receive bids for the construction of a 7 story printing plant and office building at 219-29 West 40th St. Estimated cost, $500,000. Lockwood, Greene & Co., 101 Park Ave., Archts. and Engrs.

N. Y., Rochester—The Rochester Printing Co. plans to build an addition to its printing plant at 59-63 Main St. Estimated cost, $50,000.

O., Cleveland—The Hough Ave. Home Bakery, 8708 Hough Ave., has awarded the contract for the construction of a 1 story, 51 x 114 ft. bakery and commercial building, on Hough Ave. Estimated cost, $40,000.

O., Kenmore—The Palmer Match Co., Akron, is receiving bids for the construction of the 1st unit of its match factory here, 2 story, 82 x 225 ft. Estimated cost, $50,000. Ultimate cost, $700,000. Noted Aug. 4.

O., Youngstown—The Lake Erie Limestone Co., 906 Wick Bldg., is receiving bids for the construction of a 3 story, 34 x 34 ft. screen house. Estimated cost, $10,000. Private plans.

Pa., Franklin—G. E. Glines, F. A. Howard, and other business men of Franklin, plan to build a milk plant on 10th St. Estimated cost, $25,000. Architect not announced.

Pa., Phila.—Wertz & Volk, c/o D. D. Wertz, Archt., Real Estate Trust Bldg., has awarded the contract for the construction of a 1 story, 62 x 70 ft. slaughter house at 2838-44 North 28th St. Estimated cost, $25,000.

Pa., Phoenixville—The Weiland Packing Co., 551 West Bridge St., is receiving bids for the construction of a 3 story, 53 x 62 ft. sausage factory. Estimated cost, $60,000. T. A. Stoutenberg, 1509 Champlost Ave., Phila., Engr.

Pa., Pittsburgh—H. J. Heinz Co., 1062 Progress St., will soon award the contract for the construction of a 6 story, 92 x 150 ft. spaghetti factory. Estimated cost, $150,000. S. A. Hall, c/o owner, Archt.

Wis., Holmen—The Holmen Creamery Assn. will receive bids until April 24 for the construction of a 2 story, 70 x 72 ft. creamery. Estimated cost, $35,000. V. Keppel, Mgr. Private plans.

Wis., New London—Hamilton & Sons Canning Co. plans to build a 2 story addition to its canning plant. E. Hamilton, Pres. Private plans.

Wis., Stevens Point—Pfiffer Lumber Co., 229 Franklin St., will build a 2 story, 60 x 100 ft. planing mill on Franklin St. Estimated cost, $48,000.

Ont., Courtright—The Diamond Crystal Salt Co., St. Clair, Mich., is having plans prepared for the construction of a salt refining plant with a capacity of 700 bbl. daily. Estimated cost, $60,000. F. Moore, Mgr.

Ont., Dundas—The Thornton Blanket & Woolen Co., R. R. No. 1, plans to build a 2 story, 60 x 84 ft. blanket factory. Estimated cost, $18,000. Architect not selected.

Ont., Galt—The Riverside Silk Mills has awarded the contract for the construction of a 3 story, 50 x 100 ft. addition to its factory on River St. Estimated cost, $100,000.

Ont., Ottawa—The Ottawa Dairy Ltd., 393 Somerset St., W., plans to alter and build additions to its dairy. Estimated cost, $75,000. J. Bingham, Mgr.